No. 2607 VOLUME 75 FRIDAY 9 JANUARY 1959

FLIGHT
and Aircraft Engineer

FIRST AERONAUTICAL WEEKLY IN THE WORLD: FOUNDED 1909

Editor-in-Chief
MAURICE A. SMITH D.F.C.

Editor
H. F. KING M.B.E.

Technical Editor
W. T. GUNSTON

Production Editor
ROY CASEY

IN THIS ISSUE

From All Quarters 52
TSR.2 54
New Year Honours 55
First Man-made Planet 56
Britannia 253 Takes the Air 57
Why do Birds Fear Helicopters? 58
Russian Helicopters 59
Vanguard 61
Air Commerce 77
Service Aviation 81
Straight and Level 83
Correspondence 84

Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1; telephone Waterloo 3333; telegrams Flightpres Sedist London. Annual subscriptions: Home £4 15s, Overseas £5, Canada and U.S.A. $15.00. Second Class Mail privileges authorized at New York, N.Y.

Branch Offices Coventry: 8-10 Corporation Street; telephone Coventry 25210. Birmingham: King Edward House, New Street, 2; telephone Midland 7191. Manchester: 260 Deansgate, 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow: 26B Renfield Street, C.2; telephone Central 1265. New York, N.Y.: Thomas Skinner & Co. (Publishers) Ltd., 111 Broadway, 6; telephone Digby 9-1197.

© Iliffe & Sons Ltd., 1959. Permission to reproduce illustrations and letterpress can be granted only under written agreement. Brief extracts or comments may be made with due acknowledgement.

Russia's Year of Destiny

ONE week ago we could adduce no more remarkable achievement in "the new realm" of astronautics than that of America in sending a rocket one-third of the distance to the Moon. On the very Friday morning that *Flight* appeared with that affirmation the Russians launched their "Planet III"; and by Saturday night the world had received notice that the vehicle was by-passing the Moon and was reaching sunwards. Within days of these words appearing it should be orbiting round Old Sol himself—albeit at the respectful distance of about 100 million miles.

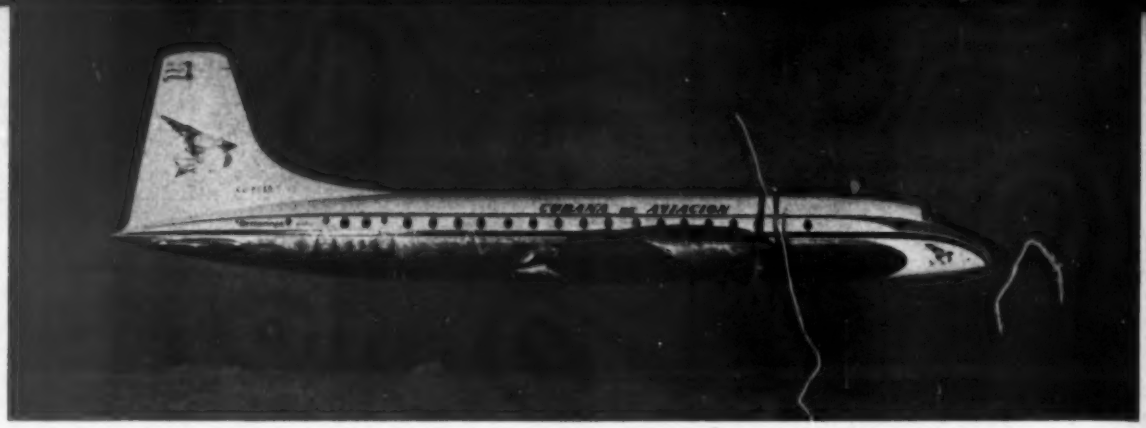
This first clean break-out from the earth's gravitational field has sent a great thrill around the puny 25,000-odd miles of our own little planet: a thrill of wonder—of apprehension even, so awesome are its implications. Congratulating the Soviet scientists, President Eisenhower has declared that this latest launch "represents a great stride forward in man's advance into the infinite reaches of space." That Ike is right will be the vote of all parties and races of the earth.

The launch of the "Planet III" and new facts about the Soviet helicopters presented in this issue prompt a fresh appraisal of Russia's standing in the aviation world. The Russians have a tremendous national pride in their aeronautical achievements; and the cynicism and open disbelief with which some of their claims have been received in the Western world can erase none of the records standing to their credit in that ledger of international aeronautics the bulletin *Records Officiels* of the Fédération Aéronautique Internationale. In civil aviation Russia holds a strong hand; and she is likely to show her cards openly in this new year, especially on the occasion of the first World Congress of Flight at Las Vegas and at the Paris Aero Show. *En route* to Nevada the enormous Tu-114 may demonstrate that it can take the Moscow - New York trip in its stride—give evidence, in fact, of longer range and greater capacity than any other airliner.

O.R.339 Becomes TSR.2

THE team of manufacturers to meet the Air Ministry's General Operational Requirement No. 339 for a comprehensive tactical attack system has at last been chosen (details—p. 54). No previous British military aeroplane has been called upon to fulfil such critical and conflicting requirements. No previous machine has been of such intense interest to the worried leaders of our aircraft and component firms—nor, for that matter, the daily Press, who have found in it a storm-centre of unparalleled magnitude.

Fleet Street has suggested that research and development will cost from £25m to £50m, that the substantial number of aircraft needed will run away with another £200m and that the first squadron of TSR.2s—as the machine is at present styled—may be formed in 1964. These predictions are likely to prove optimistic. Nevertheless, when the whole vast weapon-system is fully developed it should prove versatile, exportable, of great assistance in planning a supersonic transport and—by no means least—a bread-and-butter line for a thousand factories from the vast sprawl of Weybridge to the most humble one-man business. Many firms are already profoundly relieved to see the prospect of relatively steady work for ten years to come. Other contracts soon to be placed should remove the furrows from a still wider circle of brows.



CUBAN REVOLUTION: The first of four Britannia 318s ordered by Compañia Cubana inaugurated scheduled services on December 22 between Havana—whither it had been delivered the previous week—and New York. The operation of Cubana services may have subsequently been affected by the overthrowing of the Batista regime

FROM ALL QUARTERS

Russia's Space Achievement

THE first launching of a man-made object into orbit around the sun was achieved with the firing by the Soviet Union of their rocket Planet 3 on Friday last, January 2. Details of this feat, which resulted in scientific information being gathered from the Moon at a distance of only 4,660 miles, are reported on page 56.

New Chief of the Defence Staff

APPOINTED to succeed Marshal of the R.A.F. Sir William Dickson next July as Chief of the Defence Staff, Admiral of the Fleet Earl Mountbatten of Burma is to be succeeded in May as First Sea Lord by Admiral Sir Charles Lambe, at present C-in-C. Mediterranean.

Earl Mountbatten, who has been First Sea Lord since April 1955, thus becomes the second holder of a post which was created in July last year. Sir William Dickson, its first holder (who is retiring on half-pay when he relinquishes his appointment), was previously chairman of the Chiefs of Staff Committee and in 1957 had been given the additional title of Chief of Staff to the Minister of Defence. These titles were abolished when the post was re-named.

Admiral Lambe has an active interest in aviation, having qualified as a free-balloon pilot in 1918 and gained his "A" licence in 1929. Among his previous appointments have been those of Assistant Chief of Naval Staff (Air) at the Admiralty, Flag Officer Flying Training, Flag Officer Commanding the 3rd Aircraft Carrier Squadron, Home Fleet, and Flag Officer Air (Home).

Senior R.A.F. Changes

SEVERAL changes in senior R.A.F. posts have been announced by the Air Ministry this week. Air Chief Marshal Sir Theodore N. McEvoy, K.C.B., C.B.E., is to become Air Secretary from May 1 and will be succeeded as Chief of Staff at Allied Air Forces Central Europe from February 2 by Air Marshal W. H. Merton, K.C.B., O.B.E. (portrait, p. 81).

The present Air Secretary, Air Marshal Sir Denis F. H. Barnett, K.C.B., C.B.E., D.F.C., is to be Air Officer Commanding-in-Chief, Transport Command, from May 4. He will thus succeed Air Marshal Sir Andrew McKee, K.C.B., C.B.E., D.S.O., D.F.C., A.F.C., who is retiring from the R.A.F.

Air Marshal Merton's present post as Air Officer-in-Charge of Administration, Bomber Command, will be taken over from tomorrow (January 10) by A.V-M. B. K. Burnett, D.F.C., A.F.C.

Rotodyne Sets the Pace

IT happens that this issue carries an unusual amount of news concerning big transport helicopters. On page 59 there are new details of Russia's giant Mi-6 and on page 80 is an interim note on the prospects for our own Fairey Rotodyne in B.E.A. service. As we close for press comes the magnificent news that last Monday, January 5, the Rotodyne set up a new 100 km closed-circuit record of 190.9 m.p.h., subject to F.A.I. confirmation. Especially significant is the fact that not only does the new mark exceed the current 100 km closed-circuit record for helicopters by 49 m.p.h., but it surpasses the world's absolute speed record for helicopters by 29 m.p.h. Both records were formerly held by the U.S.A. The Fairey company has made the following statement:—

"The closed-circuit record category was chosen because it represents most closely the type of operation for which the Rotodyne is primarily intended—inter-city transport with vertical take-off. It also allows the aircraft to demonstrate under F.A.I. official conditions a genuine cruising speed over a reasonable distance. The flight was timed and measured by Royal Aero Club observers over a course between White Waltham and Hungerford, Berks. It has enabled the speeds claimed by Fairey for their revolutionary aircraft to be confirmed by independent official observers since the Rotodyne was flying on cruising power at the operational all-up weight consistent with its present Napier Eland engines. Pilot, S/L. Ron Gellatly, second pilot Lt-Cdr. John Morton. Since its first flight the Rotodyne has made more than 150 flights."

Lightning Attains Mach 2

DURING one of a series of high-speed test flights over the Irish Sea made in the last three months, W/C. R. P. Beamont flew the first English Electric Lightning, XA 847, at over Mach 2 at high altitude, maintaining that speed with the minimum reheat setting of the two Rolls-Royce Avon engines. The aircraft carried the standard ventral tank, missile pylons and instrumentation equivalent in weight to the full warload. The run was started at 35,000ft and Mach 0.95 ten miles north of Colwyn Bay and continued under military radar control in a northerly direction, Mach 2 being stabilized at something over 40,000ft. Although this machine was not fitted with autostabilizers, Beamont reported that control and stability were "eminently satisfactory."

English Electric state that "this makes the Lightning the fastest twin-engined, all-weather fighter in full production." Both single- and two-seat versions are the subject of substantial orders. Some 41 pilots have now flown the type. The company hopes that a requirement will be stated for still higher speeds.

SUCCEEDING Sir Cyril Musgrave in March as Permanent Secretary at the Ministry of Supply, Mr. William Strath, C.B., M.A. (left), is at present serving on secondment from the Civil Service as a full-time member of the Board of the Atomic Energy Authority. His previous appointments have included service at the Treasury (1948-55), M.A.P. (1940-45) and Air Ministry (1938-40)

NEW POSTS have been announced (see above) for Air Chief Marshal Sir Theodore N. McEvoy, seen at right, and Air Marshal Sir Denis F. H. Barnett (far right)

"The Small World" Gets There

AS we go to press we learn of the successful conclusion of the enterprising attempt by the British crew of the balloon G-APOB, *The Small World*, to cross the Atlantic from the Canary Islands to the West Indies. Forced down by a storm after flying some 1,200 miles in three days, "Bushy" and Tim Biloart and Colin and Rosemary Mudie cut the envelope adrift and sailed the remaining 1,800 miles in the car, which was designed by Mr. Mudie (as explained by him in a *Flight* article on November 21) for just such an emergency. They reached Barbados 24 days after take-off. Whether this counts as an aeronautical or a marine achievement, or both, it was certainly a notable feat of navigation and endurance.

New Gliding Trust

CONTROL of Slingsby Sailplanes Ltd. has now passed into the hands of the Shaw Slingsby Trust Ltd., a newly formed body of which Philip Wills, John Furlong and Basil Meads are the first council-members. The Slingsby company will continue its activities as before, but distributed profits will go to the trust, which will support the British gliding movement in much the same manner as does the Kemsley Flying Trust.

The original founder of Slingsby Sailplanes Ltd., Maj. J. E. D. Shaw, died in April 1955 and this latest change follows the recent decision of his trustees to dispose of his interest in the company. The new trust now owns the entire share capital of Slingsby Sailplanes and has registered offices at 25 City Road, London, E.C.1. The chairman of the trust and of Slingsby Sailplanes Ltd. is Mr. Philip Wills, and Mr. F. N. Slingsby remains managing director of the Slingsby company.

Canadian Fairey Appointments

CHANGES in the Board of the Fairey Aviation Co. of Canada Ltd. were announced last week. Mr. S. G. Dixon, O.B.E., Q.C., relinquishes the presidency in order to become chairman, and Mr. C. E. Hibbert, M.B.E., succeeds him as president.

Mr. C. E. Hibbert

Mr. A. C. Earle

Coincidentally with these changes, Mr. A. C. Earle, formerly plant manager, becomes general manager. Before joining the company he had served with Fairey in England for 22 years.

Pioneers for Malaya

WHEN the Malayan High Commissioner, His Excellency Tunku Ya'acob, formally accepted one Twin and two Prestwick Pioneers for the Royal Malayan Air Force at Prestwick on December 29 (see pictures and further description, p. 60), he said: "The Pioneer has come to stay in Malaya. The Government, having tried the first one, thought it would be wise to carry on with it. I hope this will be followed by many more orders as long as we have the money."

The Duke of Hamilton and Brandon, chairman of Scottish Aviation Ltd., said in handing over the Pioneers that he was glad to speed them on their way with the warmest good wishes for their usefulness with the Royal Malayan Air Force. Scottish Aviation felt that there was a great demand for its products in parts of the world where it would be beneficial to the people to be linked by aviation and where high speed and payload were not the first requisites.

Investing in Aircraft

THE end of 1958 provided an abundance of seasonable cheer for most investors: the *Financial Times* index for industrial Ordinary shares had risen over the twelvemonth by 36 per cent. Yet the year was a disappointment for investors in the aircraft industry, for their shares rose in value during 1958 by a mere 1 per cent, the lowest average rate for any sector of industry.

Four companies—de Havilland, Fairey, Handley Page and Hawker Siddeley—showed moderate improvement, Rolls-Royce gained 16 per cent, while Blackburn, Folland and Westland did particularly well; but these gains were offset by the 24 per cent decline in the value of Bristol shares.

MR. H. G. NELSON, M.Inst.C.E., M.I.Mech.E., M.I.E.E., managing director of the English Electric Co. Ltd., has been appointed deputy chairman of six subsidiary companies in the English Electric group, D. Napier and Son Ltd., Marconi's Wireless Telegraph Co. Ltd., Marconi Instruments Ltd., English Electric Valve Co. Ltd., Vulcan Foundry Ltd. and Robert Stephenson and Hawthorns Ltd. He also becomes deputy chairman of the group's associated company, the Marconi International Marine Communication Co. Ltd.

Unhappy New Year for Croydon

THE uncertainty concerning the New Year operations of the flying clubs based at Croydon Airport, who within a few days of the end of December were faced with the prospect of ceasing to fly at Croydon yet of not being able to operate from Biggin Hill, was resolved to some extent by an M.T.C.A. statement telephoned to Croydon at 4.30 p.m. on Tuesday, December 30. This said that "The Minister has agreed to 'position flying' by clubs from Croydon, as from the time that the R.A.F. are ready to receive them at Biggin Hill, up to January 31, 1959, subject to a maximum of 20 movements per day." This decision followed the meetings between Croydon Airport users and Ministry officials held on the afternoon of December 29 and the morning of December 30.

The previously stated Government decision was that all club flying at Croydon must cease after December 31, but that other (non-club) users could continue to operate there for "a very limited period" while alternative accommodation was arranged. The December 30 decision resulted in the Croydon clubs (the two largest being Surrey Flying Club and Airways Aero Association) being almost completely grounded on Thursday and Friday of last week. The R.A.F. at Biggin Hill became "ready to receive them" on Saturday, January 3, when position flying from Croydon and circuits and other training at Biggin Hill began.

IN BRIEF

A director of Dowty Fuel Systems Ltd. for the past two years, Mr. Norman H. Payne, B.Sc., M.I.Mech.E., A.F.R.Ae.S., has been appointed managing director of the company in succession to Mr. Stuart Davies, who recently left the Dowty Group to join the Hawker Siddeley Group. Mr. Payne was with Normalair Ltd. as chief engineer until he joined Dowty Fuel Systems, and had previously (from 1944 to 1952) been chief development engineer for piston engines with the de Havilland Engine Co. Ltd.

* * *

Following a successful period of development with the two prototype P.531 helicopters, Saunders-Roe Ltd. are proceeding with the manufacture of a number of Mk 1 production aircraft.

* * *

Mr. J. G. Burns has been appointed a test pilot with Blackburn and General Aircraft Ltd. He was formerly with Hunting Aircraft Ltd., whom he joined after leaving the R.A.F. in February last year.

* * *

Formerly head of the guidance and control department, guided weapons, at Short Brothers and Harland Ltd., Belfast, Dr. O. P. Mediratta has been appointed Deputy Director (Research and Development) at the Directorate of Technical Development and Production (Air), Ministry of Defence, New Delhi. He is leaving this month to take up his new Indian Government appointment.

* * *

Mr. Henry Kremer

Microcell Ltd. announced last weekend that an agreement had been reached in principle whereby their group of companies will be merged with the BTR Industries group. The present Microcell directors will continue in office and Mr. Henry Kremer will remain chairman and managing director; he will also join the Board of BTR Industries. Dr. W. D. Scott, BTR assistant managing director, and Maj. C. J. P. Ball, another BTR director, are to join the Microcell Board. With main factories at Camberley and Blackwater, Surrey, Microcell have three main divisions—aircraft engineering, plastics and electronics. Aircraft seats are among the company's products which have recently attracted attention.

* * *

At the 27th annual meeting of the Institute of the Aeronautical Sciences in New York, to be held from January 26 to 29, no fewer than 104 technical papers and discussions will be presented on aspects of aerodynamics, structures, propulsion, thermal stress, aeroelasticity, astronautics, VTOL aircraft, flight testing, supersonic transports, all-weather jet transport operations, and meteorology. Guest speaker at the Honours Night Dinner will be Dr. T. Keith Glennan, administrator of the National Aeronautics and Space Administration.

TSR.2

OUTCOME OF O.R.339: A MULTI-PURPOSE AIRCRAFT FOR THE R.A.F.

ON January 1 a statement of great interest and importance was made by the Minister of Supply. It said that, subject to satisfactory negotiations, the development of the new R.A.F. aircraft, the TSR.2, "would be undertaken jointly by Vickers-Armstrongs and English Electric, the main contract being placed with Vickers-Armstrongs and the work being shared between the two companies on a fifty-fifty basis. A joint project team drawn from both companies is being established at Vickers' works at Weybridge for the execution of the project." The Minister's statement continued:—

"Subject equally to satisfactory negotiations, the development of the engine for the new aircraft will be undertaken by Bristol-Siddeley Engines, the new company formed out of Bristol Aero-Engines and Armstrong Siddeley Motors, subsidiaries respectively of the Bristol Aeroplane Company and the Hawker Siddeley Group. Both these engine companies have indicated that they are now proceeding to a complete financial integration.

"The TSR.2 is a tactical support and reconnaissance aircraft. The specification was originally based on General Operational Requirement No. 339. In the course of study it has been found technically possible to incorporate in the final Operational Requirement modifications which will greatly increase the usefulness of the aircraft in limited operations and for close support of the Army, particularly by reducing the length and strength of runways required for take-off. While the TSR.2 will be capable of performing the rôles of all the various marks of Canberra, it will, by reason of its greater flexibility and higher general performance, be far more versatile and more in the nature of a general-purpose tactical aircraft."

What the Announcement Implies

It is well over a year since companies started work on projects to meet O.R.339, and during this period much has been suggested of "battles in Whitehall"; the announcement is already unofficially claimed to represent "victory for the air marshals" and to have caused "a red face for Mr. Duncan Sandys, the Defence Minister, who told the R.A.F. it would get no more manned bombers."

In actual fact, all concerned have co-operated closely to ensure that the R.A.F. will get the best weapon system at the earliest date for the least cost.

But deciding upon the best weapon system has proved to be a labour of Hercules; and changing requirements, new techniques and the impossibility of accurately forecasting the situation of a decade hence have combined to render this project much more difficult than any which the Air Staff or the industry have previously had to face. The sketches below suggest some of the solutions which may have been examined.

A This is a straightforward application of the VTOL principle propounded by Dr. A. A. Griffith. Fifty or more small turbojets of high thrust/weight ratio would be used as lift engines, and two of the Bristol-Siddeley engines—doubtless derived from the Olympus 15R—would provide cruise propulsion. This aeroplane would weigh about 60,000 lb, have a crew of two, fly at up to Mach 2.5 at the tropopause or Mach 1.5 at sea level, have a maximum tactical radius approaching 1,000 miles and be about 75ft long. These figures are likely to be in the neighbourhood of those required, and similar characteristics may be assumed for the other suggested projects. If lift engines are to be used they may well be by Rolls-Royce.

B Here the N.G.T.E./R.A.E. scheme of jet deflection is employed. Two engines would be used, each with a valve box through which the jet could be deflected almost vertically downward in line with the c.g. to provide lift approaching the weight. Such valves would probably be upstream of afterburners. A layout of this kind is very attractive; it would not be a VTOL, but—provided the overall thrust/weight ratio could be kept high—it would certainly get off in a few hundred yards.

C Here the polymophic formula of Dr. Barnes Wallis—who works for the TSR.2 main contractor—is employed to give excellent all-round performance. It does seem, however, that this concept would be better suited to a long-range transport than to a rough-and-tumble military machine designed for arduous operations at all levels. Moreover, it would probably need an airfield not inferior to the present NATO platform.

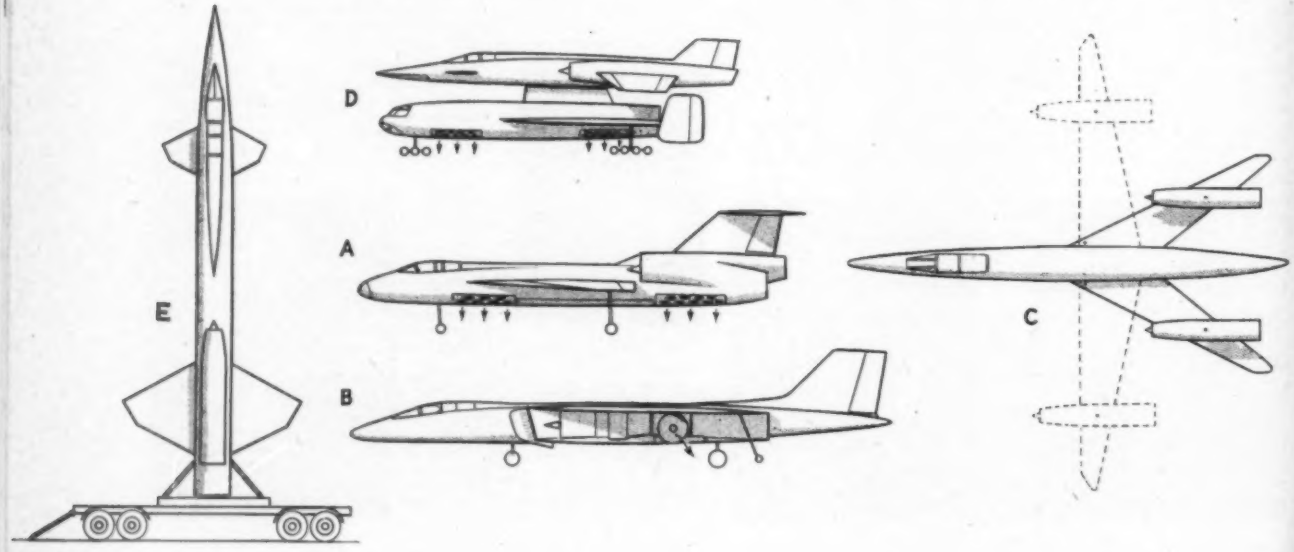
D This unlikely-looking contraption is an outgrowth of German projects of 1944-5, the main advance being the incorporation of Griffith lift engines in the lower component to confer VTO ability. The TSR.2 would be the upper machine, devoid of landing gear and designed to come back to its mother and latch on at about 300 m.p.h.—which should be no more difficult than air refuelling is today. On the other hand, the TSR.2 could have an undercarriage and return to a proper airfield after completing its mission. The lower platform-like machine would be an aeroplane in its own right, and could well double as the squadron transport and resupply vehicle.

E A manned missile, this is a development along the lines of Bloodhound. It stands on its tail and is launched by a gimballed boost rocket in the same way as Bomarc or a ballistic missile. Landing would be effected by skids and parachute (or perhaps by a proper landing gear on a hard runway).

These ideas show the diversity of possible vehicles. In addition there are other concepts. In 1941 this country flew aircraft which shed an auxiliary wing after take-off—deliberately that is. In recent months F-100s, Mig-19s and other aircraft have been launched from zero-length mountings by high-thrust boost motors; here the only ground equipment needed is a launcher (weighing under a ton) and a crane. The French Baroudeur is a neat way of taking off from a trolly designed for rough terrain, and any fixed-wing aeroplane can be pulled up inside a hundred yards by a suitable arrester gear.

Whatever form TSR.2 will take it is likely to differ radically from anything else in the world. Some opinions on the implications of this aircraft are given in a leading article in this issue.

Some hypothetical solutions to the problems posed by O.R.339. All these machines would be roughly the same size as the Avro Arrow, have a crew of two and a pair of reheated Bristol-Siddeley Olympus turbojets for cruise propulsion. Each is discussed in the text above



Left to right: Lord Alexander of Tunis (O.M.), Mr. A. F. Burke (Kt.), Maj-Gen. C. A. L. Dunphie (Kt.), Mr. G. W. H. Gardner (K.B.E.), Mr. S. E. Clotworthy (C.B.E.)

The New Year Honours

AVIATION is better represented in the New Year Honours List than on some earlier occasions. Among well-known names are those of Sir William Rootes (of war-time aircraft "shadow factory" fame and now doing less direct but no less valuable work for the industry as chairman of the Dollar Exports Council; he receives a barony); Mr. A. F. Burke of de Havilland and Maj-Gen. Dunphie of Vickers, who receive knighthoods; Mr. G. W. H. Gardner of the R.A.E., who is appointed K.B.E.; and Mr. T. Bancroft of Blackburn Aircraft, Mr. D. J. Farrar of Bristol and Maj. P. L. Teed of Vickers, all O.B.E. Names familiar in the ancillary industry include those of Lord Alexander of Tunis (O.M.) and Mr. S. E. Clotworthy (C.B.E.), respectively chairman and managing director of Northern Aluminium; and Mr. M. Cook (C.B.E.), chairman, I.C.I. Metals. Several awards of the Queen's Commendation reflect sterling service by test pilots and airline crewmembers. All the names on this page are in the civil divisions; Service honours are listed on pp. 81-82.

Mr. D. J. Farrar, Mr. T. Bancroft and Maj. P. L. Teed (O.B.E.s)

BARON

Sir William Rootes, chairman, Dollar Exports Council.

ORDER OF MERIT

Field Marshal the Earl Alexander of Tunis.

KNIGHTS BACHELOR

A. F. Burke, deputy chairman and managing director, de Havilland Aircraft Co. Ltd.; Maj-Gen. C. A. L. Dunphie, managing director, Vickers Ltd.; J. W. Laing, president, John Laing and Son Ltd.; A. Cdre. H. P. Smyth-Osbourne (for political and public services in Devon).

ORDER OF THE BATH

C.B.

A. Cdre. A. R. Churchman, chairman, T. and A.F.A., Belfast; M. M. V. Custance, deputy secretary, M.T.C.A.; W. B. Littler, Director-General of Scientific Research (Munitions), M.o.S.; G. S. Whittuck, Asst. Under-Secretary of State, Air Ministry.

ORDER OF ST. MICHAEL AND ST. GEORGE

C.M.G.

B. G. Barnard, Civil Air Attaché, H.M. Embassy, Beirut.

ORDER OF THE BRITISH EMPIRE

K.B.E.

G. W. H. Gardner, Director, Royal Aircraft Establishment, Farnborough.

C.B.E.

S. E. Clotworthy, managing director, Northern Aluminium Co. Ltd.; M. Cook, chairman, I.C.I. Metals Division; E. C. de Rougemont (for services to R.A.F. Benevolent Fund); F. C. Fayers, asst. secretary, Air Ministry; C. H. Latchford, Director-General of General Services, M.o.S.; R. A. Lovell, Chief Mechanical Engineer, M.T.C.A.; R. J. Pinder, managing director, Esso Petroleum Co. Ltd.; J. A. Ratcliffe, chairman, Radar and Signals Advisory Board, M.o.S. Scientific Advisory Council; K. Robson, civil consultant in medicine to the R.A.F.; R. H. Schlotel, Director of Eng. R. and D., M.o.S.

O.B.E.

G. F. W. Adams, principal, Air Ministry; T. Bancroft, production and works director, Blackburn and General Aircraft Ltd.; D. L. Brown, Asst. Director of Engine Research and Development, M.o.S.; G/C. J. Bussey, lately Asst. Director (Air), Directorate of Overseas (Geodetic and Topographic) Surveys, Colonial Office; H. C. Carrad, general manager, Shell Petroleum Co. Ltd., Austria; G. S. Cooper, superintending civil engineer, Air Min.

C. H. Easthop, chief executive officer, Air Ministry; F. C. Everett, principal scientific officer, Armaments Production Division, M.o.S.; D. J. Farrar, chief designer (guided weapons), Bristol Aircraft Ltd.; G. W. Harvey, principal, M.T.C.A.; C. V. Hill, lately refining advisor, British Petroleum Co. Ltd.; H. S. Humphreys, lately Deputy Director of Contracts, M.o.S.

J. Middlemas, air traffic control officer, Prestwick Airport, M.T.C.A.; A. E. Morrison, managing director, Moore and Wright (Sheffield) Ltd.; M. N. Oxford, Director of Civil Aviation, Federation of Malaya; Rev. R. L. Small, member of Scottish Air Cadet Council and Regional Chaplain, Air Training Corps, Scotland; Maj. P. L. Teed, deputy director of aeronautical research and development, Vickers-Armstrongs (Aircraft) Ltd., Weybridge.

M.B.E.

S. H. Crawford, lately secretary of Australian National Airlines Commission; A. C. Emery, chief draughtsman, telecommunication group, Plessey Co. Ltd.; F/L. J. Formby, flight commander, meteorological vertical-ascent flight, Short Brothers and Harland Ltd., R.A.F. Woodvale; R. G. Goodfellow, senior station radio officer, R.A.F. Cheadle; F. Grundy, meteorologist, East African Meteorological Dept.; G. M. Harvey, projects manager, Transair Ltd.; R. H. E. Hosking, higher executive officer, M.T.C.A.; A. E. P. Irish, senior illustrator, R.A.F. Staff College, Bracknell; S. A. Jeanmond, station catering superintendent, B.E.A., London Airport.

W. S. Kennedy, Chief Aerodromes Officer, Federal Department of Civil Aviation, Rhodesia and Nyasaland; Doris G. Lea, lately senior experimental officer, Meteorological Office, Air Ministry; W. E. Mann, area finance officer, Department of Air, Melbourne; C. B. Martin, inspector of works (buildings), No. 7 Works Area, Honington, Air Ministry; Mrs. Rose M. Munford, executive officer, M.T.C.A.; E. G. Peers, communications officer, London Airport, M.T.C.A.; L. Pinder, lately Senior Inspection Officer (Aircraft), M.o.S.; L. J. Pitt, safety and civil defence officer, Fielding and Platt Ltd., Gloucester.

C. Rowley, asst. chief of armament design, Vickers-Armstrongs (Engineering) Ltd.; R. Saunsbury, vice-chairman, Manchester Wing Committee, Air Training Corps; Maureen Betty Skinner, clerical officer, Air Ministry; W. S. Stambridge, consultant, Rubery, Owen and Co. Ltd.; C. E. Strange, higher executive officer, M.T.C.A.; A. E. V. Sturrock, pay superintendent, B.O.A.C.; Mrs. Doreen I. Wackett, president, Air Force Women's Association, Australia; F. C. Wells, exper. offr., Signals R. and D. Dept., M.o.S.; T. F. White, sen. exec offr., Air Min.; A. L. Wilson, Engineering Technical Class, Explosives Research and Development Establishment, M.o.S.; G. S. Wood, member of committee, No. 331 (Chesterfield) Sqn., A.T.C.; K. J. Woodgate, superintending inspector, A.I.S., Air Min.

QUEEN'S COMMENDATION FOR VALUABLE SERVICE IN THE AIR

Lt-Cdr. J. Elliot, chief test pilot, Christchurch factory, de Havilland Aircraft Co. Ltd.; Capt. H. J. Field, senior captain, 1st class, B.O.A.C.; S/L. H. G. Hazelden, chief test pilot, Handley Page Ltd.; Capt. P. J. McKeown, senior captain, 1st class, B.E.A.; Capt. A. Meagher, deputy flight manager, Britannia 312 Fleet, B.O.A.C.; J. Miller, flight radio officer, B.O.A.C.; G. W. Rodgers, radio officer, B.E.A.

Lt.-Cdr. "Jock" Elliot, S/L. H. G. Hazelden and Capt. A. Meagher (Queen's Commendations for Valuable Service in the Air)

THE FIRST MAN-MADE PLANET

Russian Rocket Launched into Solar Orbit

THE greatest step forward in astronautics since the launching of Sputnik 1 on October 4, 1957, was the Soviet firing, on Friday, January 2, 1959, of the first rocket ever to escape from the Earth's gravitational field. Known unofficially as Planet 3, the rocket passed within 5,000 miles of the Moon and went on to become the first man-made object to begin an orbit around the Sun—at a mean distance from the Sun of roughly 100 million miles and with an estimated orbital period of 15 months.

The first announcement of the launching was given by Moscow Radio on the night of January 2. After recalling the launching of the Soviet Earth satellites, the statement continued:—

"As a result of further creative work on the part of Soviet scientists, designers, engineers and workers a multi-stage rocket, the last stage of which can reach a second cosmic speed of 11.2 km per sec (about 7 miles per sec), making interplanetary flights possible, has now been created. On January 2, 1959, a cosmic rocket was launched towards the Moon in the U.S.S.R. The multi-stage cosmic rocket has come out according to programme on the trajectory of its movement in the direction of the Moon. . . .

"According to preliminary calculations, which are being made more precise by direct observation, the cosmic rocket will reach the area of the Moon at approximately 07.00 hr Moscow time (4 a.m. G.M.T.) on January 4. . . .

"The last stage of the cosmic rocket, weighing 1,472 kg (3,245 lb) without fuel, is equipped with a special container, inside which are placed the measuring instruments for carrying out the following scientific observations: the ascertaining of the magnetic field of the Moon; the study of the intensity and the variations of the intensity of cosmic rays outside the magnetic field of the Earth; the registration of photons in cosmic radiation; the discovery of the radio-activity of the Moon; the study of the distribution of heavy nuclei in cosmic radiation; the study of the gas components of interplanetary matter; the study of corpuscular solar radiation; and the study of meteoric particles."

The statement said that radio transmitters working on four frequencies were relaying to Earth the data obtained. Among the instruments were some designed to create a sodium cloud which would be released during ascent to form an artificial comet visible from the Earth. The total weight of the instrument payload, including batteries and container, was 361.3 kg (296.5 lb).

The statement also said that the rocket was carrying pennants with the coat of arms of the U.S.S.R. and the inscription "Union of Soviet Socialist Republics, January 1959." The announcement concluded: "The workers of scientific research institutions, designing bureaux, plants and testing organizations who have created the new rocket for interplanetary communications dedicate this launching to the 21st Congress of the Communist Party of the Soviet Union."

At 2.59 a.m. G.M.T. on Sunday, January 4, according to the Soviet news agency Tass, the rocket passed 4,660 miles west of the Moon with all instruments and radio transmitters functioning normally. Its speed at that time was some 5,500 m.p.h. At 9 a.m. G.M.T. the same day, it was 265,000 miles from Earth (and 37,500 miles from the centre of the Moon). The internal temperature and that on the exterior of the rocket were both reported as 10-15 deg C.

The Tass statement added: "With the growing distance between the rocket and the Earth, as well as under the influence of the extinction of energy sources aboard the rocket, the radio contact with the rocket will gradually become more and more difficult, and possibly cease within the next 24 hours. . . . As the cosmic rocket recedes from the Earth and the Moon their influence on the rocket's movement will weaken. The movement of the rocket will, to an ever-increasing degree, be determined only by the force of attraction of the Sun. The rocket will enter into its final elliptical orbit round the Sun, thus becoming the very first artificial planet of the solar system. In practice this will occur as from January 7-8."

On January 14, the agency stated, the rocket would be about 91.5 million miles from the Sun—its closest position—and at the beginning of September the maximum distance from the Sun, about 122.5 million miles, would be reached. The time for one revolution would be 15 months.

On Monday, January 5, Tass reported that radio contact with the rocket had been lost that day at 7 a.m. G.M.T., at which time the rocket's distance from Earth had been 371,000 miles. The rocket was continuing its flight, the statement said, but "the programme of tracking the rocket and the scientific research connected with it have been thereby closed." The tasks laid down at the launching of the rocket had been completed, and the scientific results obtained would be published.

Among messages of congratulation on the Russian achievement was one from Mr. Harold Macmillan, the Prime Minister, and one from President Eisenhower. Informed opinion was that the accuracy of guidance of the rocket was even more impressive than the provision of its power—although it was recalled that no advance statement was given of the rocket's destination. As to the probable life of the rocket, this should be measured in millions of years.

SAFE MECHANISMS

A MAIN lecture of the Royal Aeronautical Society, entitled *Safe Mechanisms*, was due to be given by Mr. Raoul Hafner, chief designer (helicopters) of Bristol Aircraft, in London yesterday, January 8. Although considerable advances had been made during the evolution of fixed-wing aircraft in the design and production of light and safe structures, Mr. Hafner's paper submitted, mechanical components had not received the same attention. They had been regarded by the structures expert as unreliable, but this point of view could not be supported by facts.

The paper was mainly concerned with the fundamental properties of mechanical components in the light of the safety concepts that had been evolved with modern aircraft structures. The cost of safety, the fault and failure relationship, and methods of inspection and design principles which effected this relationship were also discussed. Examples of "safe" mechanical components were given as well as a complete "safe" transmission system for a helicopter. Mechanical components, the paper claimed, could be made adequate for the vital role which they would be called upon to play in the ensuing phase of aeronautical evolution.

SPACE FOR YOUNG PEOPLE

AT the Royal Society of Arts last Tuesday, January 6, Dr. L. R. Shepherd, chairman of the British Interplanetary Society, gave a talk on *Rocket Flight in Space*. The occasion was the 1959 Young People's Lecture organized by the Royal Aeronautical Society.

Dr. Shepherd's lecture gave a simple account of the operation and construction of solid- and liquid-propellant rockets. He described briefly the Earth's surroundings in space and the use of rockets to overcome Earth's gravitational pull. The problems of launching artificial satellites and space probes were also detailed.

Man would take part in the exploration of space and the planets, Dr. Shepherd said, but the need to provide for his safety and his safe return to Earth created a number of difficult problems. These were outlined by the speaker, who concluded his talk by stressing the necessity for new and more powerful methods of propulsion in space. This, he emphasized, would almost certainly involve the application of nuclear energy.

ASSISTING INDUSTRIAL EFFICIENCY

NOW available is the first issue of *Data Processing*, a journal designed to cover the needs of management and administration executives in search of practical information about the application of electronic computers and associated equipment to their own particular problems.

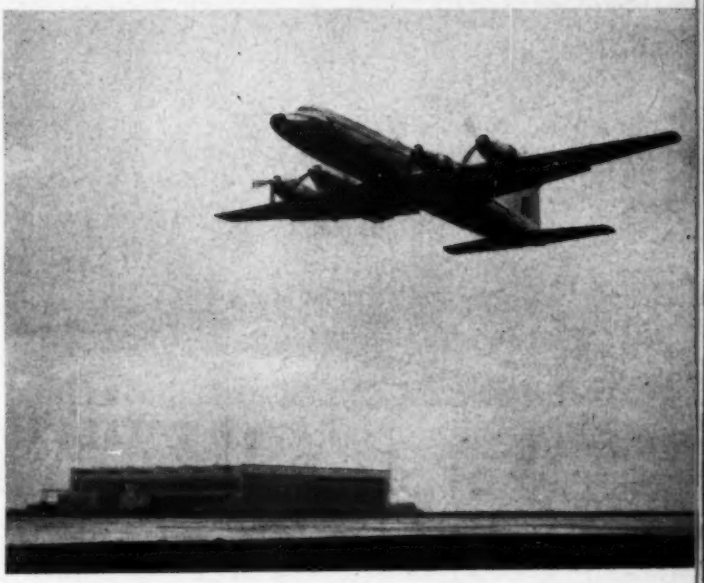
Contents of this first issue include an article on the computer services available to industry; a description of the first commercial automatic reading machine; an explanation of some basic terms, and another of the operation of an electronic digital computer; a review of the products of the principal computer manufacturers; and articles on wage accounting by the punched-card system, on high-speed data printing and on automatic quality control.

Edited by P. J. Farmer, A.F.R.Ae.S., under the editorial direction of A. B. Bourne, C.I.Mech.E., *Data Processing* is published quarterly by Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1. The annual subscription is £4 (single issue, 25s).

BROUGH PROSPECTS

IN his New Year message to Blackburn and General Aircraft employees, the chairman and managing director, Mr. Eric Turner, said that with the NA.39 and its developments alone he believed that prospects of employment with the company, all being well, were good until the mid-1960s. He added that a "major disappointment" of 1958 had been that no decision had been made on the B.107, but expressed the hope that Blackburn's experience with this class of aircraft would "eventually receive official recognition."

BRITANNIA 253 TAKES THE AIR



ON the right is seen the first take-off—on December 29—of XL 635, the first of twenty Bristol Britannia 253s for R.A.F. Transport Command. In service the aircraft will probably be designated Britannia C.1, and will be employed as a long-range trooper, freighter and ambulance aircraft. It will have a longer range than any previous British military transport, a payload comparable with that of the Beverley and a useful speed.

Decision to order Britannias for Transport Command was taken in November 1955, following cancellation of the V.1000; a contract for six was signed the following January, and this was later supplemented by repeat orders for four and ten, bringing the total to twenty. All components for these machines have been made by Short Brothers and Harland at Belfast. Shorts will assemble 15 aircraft and supply parts for the other five for assembly by Bristol Aircraft at Filton. Shorts handled most of the design-work.

Large doors are provided for bulky cargo, and in our issue of August 9, 1957, we described the hydraulic freight lift and the novel "floating" freight floor. Up to 115 seats can be installed, these being of a new, quickly stowed Short design stressed to 9g. Power is provided by four 4,445 e.h.p. Bristol Proteus 255s. These differ in several respects from any other Proteus powerplants, and are equipped with water injection to give good performance on hot and high airfields. The Britannia 253 will carry some 16 long tons (36,000 lb) over 4,100 miles at 400 m.p.h.

BELL AUTOMATIC LANDING TRIALS

REPRESENTATIVES of the U.S.A.F., R.C.A.F. and Air Materiel Command recently watched a demonstration of the Bell Automatic Landing System at Dobbins A.F.B. The aircraft used was a B-47 and Lockheed suggest that the method might in future be employed in all B-47s in service.

Bell have based their system on an automatic tracking radar and computer housed in a caravan with its own generator. The radar assesses the behaviour of the aircraft during an approach under autopilot control and compares it with a correct glide-path profile set up in an electronic computer. Error signals are generated and transmitted to the autopilot through a receiver said to be compatible with airborne I.L.S. receiving equipment. The commands are also shown to the pilot on an instrument so that he can make a manual approach under guidance from the ground equipment. At any time he may disengage the autopilot and take control—for example, when he sees the runway. Alternatively, he may allow the automatic system to take the aircraft all the way to touchdown.

A controller in the caravan has a visual indication of the radar observations and uses a plotting board marked with the correct glide-path. He can take over to direct a normal G.C.A.-type approach. The performance of the aircraft, its glide-path errors and the commands sent to it can be recorded; and the aircraft is automatically ordered to overshoot if errors become too large or equipment malfunction occurs. Correct approaches for a wide variety of aircraft types can be stored in the computer and selected at a moment's notice. Any aircraft equipped with normal I.L.S. receivers can be quickly modified to accept the automatic system, the main additional item being a radar corner-reflector—generally attached to one undercarriage leg. Bell claim that 120 aircraft could be landed every hour.

A more advanced version of this automatic equipment is being developed for the U.S.A.F. Although it will be based on the ground equipment designed for automatic carrier-landing it will have a new tracking and command system. Instead of a tracking radar and radio-command link being employed, a radar will be used to track a signal from the aircraft and commands will be superimposed on the tracking channel.

FOR ACCURACY IN COMPASS-SWINGING

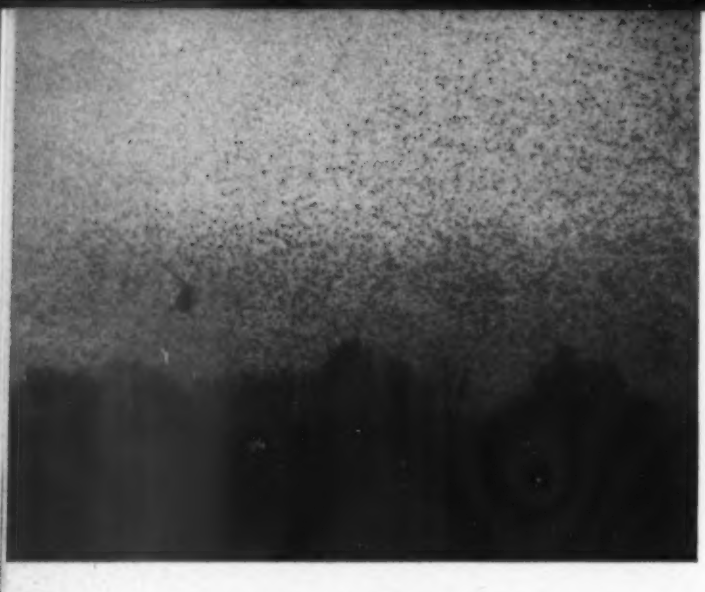
INTENDED to permit gyro-magnetic compasses to be swung to an accuracy of 0.1 deg, a new datum compass has been developed by Hilger and Watts Ltd., of London, S.E.5. It may also be used for the alignment of Doppler aerials provided they are on the aircraft centre-line.

During calibration the aircraft is towed round a 150ft-diameter circle and bearings are taken every 30 deg. No distant sighting points or compass rose painted on the tarmac are needed and a heavy aircraft need not be precisely positioned. The compass unit may be inclined about a horizontal axis to allow for magnetic dip, making its use possible anywhere in the world where the horizontal field exceeds 0.05 gauss.

The sequence of operations begins with the datum compass being levelled and aligned with the datum marks or rods on the airframe by means of a sighting telescope providing an upright ×6 image. The instrument is now turned to align a bearing plate with the compass needle, using a mirror sight to align vanes at either end of the needle for exact adjustment. The bearing plate is then released from the telescope section so that, when the telescope is once more aligned with the aircraft, an exact bearing can be read. The bearing scale is marked in tenths of a degree.

Such accurate compass swinging is required for aircraft using Doppler systems and the datum compass has been extensively used in trials with V-bombers. Civil operators are now said to be showing considerable interest.

The new Hilger and Watts datum compass set up and aligned with the airframe of a B.O.A.C. Britannia. Note positioning slide and cable control for unlocking the compass needle



". . . the comparatively slow-moving, earthward-tilting, forward-peering shape of the modern helicopter creates in the bird mind the illusion of predatory attack." An S-55 being used by the U.S.A.F. in an attempt to drive starling flocks from Rhineland vineyards

Why do Birds Fear Helicopters?

By DAVID GUNSTON

IN my recent investigations into the rather fascinating subject of avian reactions to helicopters in flight I have heard of many strange cases wherein quite large birds have shown every symptom of complete panic at the approach of the machine. Birds immediately get into the most literal of flaps when they see a rotor aircraft coming in their direction; they jink, stall, attempt to climb, lose height and flutter away ignominiously. Furthermore, most birds seem terrified of helicopters in the air even when they themselves are on or close to the ground. Wild geese, rooks, poultry and sparrows alike seem to assume that the helicopter is an enemy, and they take immediate avoiding action, often running for cover.

Similar reactions are within the experience of almost all helicopter pilots, and since first airing the subject in a Sunday newspaper I have been offered much first-hand evidence of sheer bird-fear in this connection, and an equally overwhelming volume of speculation and theory as to its causes.

For an air-minded age so devoted to watching birds this is a field of interest that has so far received scant attention from the scientific ornithologists; but it is worth examining the most likely reasons.

First, the downwash. As a Tiger Moth pilot discovered recently when he flew (or attempted to fly) beneath the Fairey Rotodyne, this may be of extreme turbulence, making normal bird-flight impossible. Consequently the crazy uncontrolled aerobatics observed in birds as big as eagles and herons may frequently be due to this cause. In particular, a bird already alarmed by the sudden appearance of a helicopter almost overhead, and instinctively trying to climb to safety, would find itself completely out of control, unable to gain height or even retain it, and exhibiting the most ungainly antics in a frantic strain to get away. This was the explanation of the panic of a heron observed recently by Bristol Aircraft test-pilot Bob Smith as he flew a Sycamore over the London-Yorkshire motorway. And it is a partial explanation of the typical reaction of birds caught in mid-air.

Another test pilot, "Slim" Sear of Westland Aircraft, enlarged on this point to me: "To further the discussion, a friend of mine said that when he was flying a Sycamore the birds on rising from the ground would fly in a clockwise direction; but when he was flying a Whirlwind, they would rise and fly in an anti-clockwise direction, i.e., the direction of the rotor rotation, though I personally have not noticed this effect." If such behaviour does occur, it would strengthen the evidence we already have on downwash as a cause of bird "panic."

In general, it is clear that, by comparison with the fairly narrow air-turbulence wake of a fixed-wing aircraft, the combined wake and downwash of a helicopter, particularly at slow forward speeds or at the hover, creates excessive local turbulence sufficient to disable any bird in flight. But the creature must be caught more or less immediately under the machine for the downward flow of air to have any pronounced effect. A bird just nearby would not normally be so affected, though it might still show every sign of panic. However, to be caught in a helicopter downwash is such a terrifying experience that if frequently experienced it may to some extent influence a bird's future behaviour in like circumstances. There is, for instance, some evidence that the bird population around an airfield continually used by helicopters learn to avoid flight in its immediate vicinity: at the Westland field at Yeovil they call their local birds "fully certificated pedestrians"!

Yet there are obviously factors other than downwash that influence birds in such striking contrast to their usual nonchalance towards fixed-wing aircraft. Some people aver that fear is induced by the distinctive noise helicopters make, claiming that they have noticed incipient fear directly the sound is heard. Yet there is little evidence that wild birds are disturbed by ordinary aircraft noise, even jet noise. They have amazingly selective hearing, ignoring the overhead roar of gas turbines yet detecting the faintest rustle of a twig in the bushes close by. In most if not all of the above cases it could be shown that sight, not hearing, played the first part in setting up fear reactions in the birds' minds.

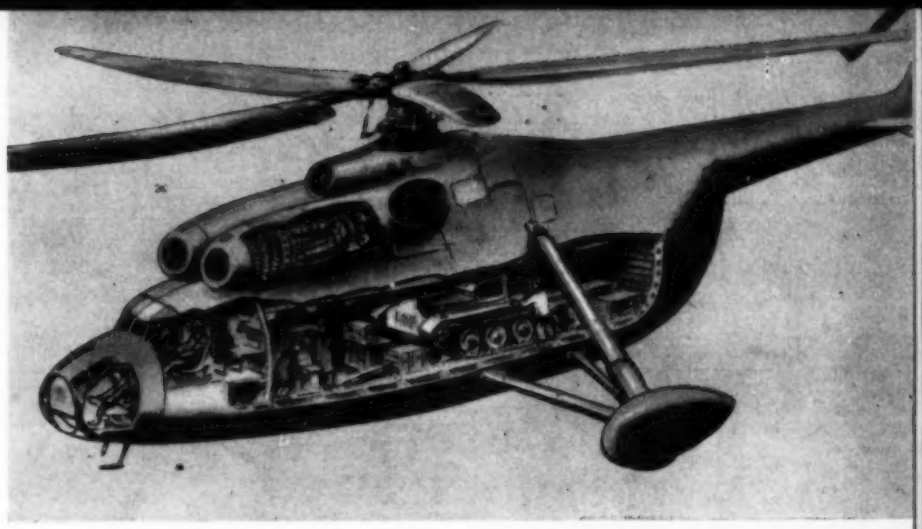
This brings us on to the vexed question of helicopter shape, outline and silhouette. Usually it is the oncoming machine—mostly, though not always, at low altitude—that scares off the rook flocks, or panics the poultry into their houses. Slow or high speed here seems to make little difference, and panic has been noticed from machines flying at 17,000ft or more, where there is no turbulence factor to contend with. Poultry in their enclosed runs seem particularly affected by the sight of the approaching helicopter. "Slim" Sear confirms this vividly: "We have a small chicken farm at the end of the airfield [at Yeovil] and flying is being carried out practically all the time, yet I still have reports from the farmer that periodically the birds panic enough to kill themselves against the wire mesh."

Now it is an indisputable fact that all birds in some degree are highly scared of what might be called the predator outline—short neck, broad wings, long tail—provided always that it moved forward neck-first. It represents the natural enemy, soaring eagle or hovering falcon, and invariably sets up fear reaction and escape mechanism. The "outline" may be just a wooden model, cardboard outline, even a harmless bird of the same shape (like a cuckoo), a large aircraft flying very high—or a helicopter flying quite low. Similar effects have been noted from dirigibles, kites, balloons and early aircraft which were frequently of this general shape (with engines small or behind the main aerofoils) or unashamedly kite-like.

There seems little doubt that the revolving rotors of a helicopter add to the illusion by suggesting hovering hawk wings, and that the comparatively slow-moving, earthward-tilting, forward-peering shape of the modern helicopter creates in the bird mind the illusion of predatory attack. Hence the immediate instinctive results.

With the growing use of helicopters it will be interesting to see whether successive bird generations grow out of this fear. Meanwhile, it needs the closest study, and I should be glad to hear from any reader with experience of it, particularly with regard to the direction of rotor movement affecting birds rising from the ground.

". . . their usual nonchalance towards fixed-wing aircraft"—displayed in this pleasing picture by seagulls towards a Hunting Sea Prince T.1



This sectional drawing, from a Russian source, shows details of the big Mi-6

DETAILS OF THE GIANT Mi-6 AND OF REMARKABLE EARLY DESIGNS

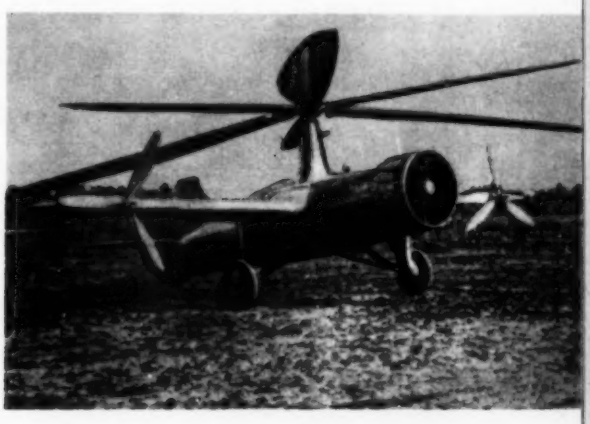
SOVIET HELICOPTERS

THE drawing at the head of this page is a Russian representation of the Mi-6 helicopter, largest of its kind in the world. In the early 1930s its designer, Mikhail L. Mil', became a research engineer in the TsAGI helicopter department. For many years he worked on autogiro development, together with Professor N. K. Skrzhinskii (who died last year), and, among others, he was responsible for the A-12 autogiro which in 1937 is claimed to have attained a speed of 160 m.p.h. and an altitude of 16,500ft. Mil' has published several research reports on aerodynamic design and controllability of single-rotor helicopters. After World War 2 he became head of the design bureau producing single-rotor helicopters of the "Yuryev-Sikorsky" configuration; and he was also a professor at the Kazan Aerotechnical Institute (KAI).

A recent Soviet report describes the power units of the Mi-6 as "special free turbines designed by Solovyev giving some 2,500 h.p. each." Having regard to the immense size of the craft, however, the power is obviously too low. The official figure is 4,700 h.p. The five-blade rotor measures over 100ft in diameter, and the disposable load is given as 12 metric tons. Possible loads are 80 fully armed soldiers or a maximum of 120 passengers. The Mi-6 at present holds the absolute world record for useful load in the rotary-wing category, and also the record for maximum altitude with a load of 12 tons. In an interview its designer has stressed the importance of the pressure-jet helicopter, which may mean that his design team will be producing a machine of this class.

The first of the small photographs shows the original Yuryev helicopter, built in 1912. Boris Nikolayevich Yuryev was a pupil of Professor N. Ye. Zhukovskii (Joukowski), the world-famous aerodynamicist. In 1911 Yuryev obtained a patent on a helicopter having a single main rotor and a torque-balancing tail rotor—a scheme which was later developed in the U.S.A. by one of his former fellow students at the Moscow Technical High School, Igor Sikorsky. Apart from using wire-braced main-rotor blades, the helicopter seen in the picture (in the backyard of the Moscow Technical High School) is remarkably similar to single-rotor machines of far later production. After the October Revolution Yuryev became one of the leading scientists who reorganized the TsAGI research institute. For almost three decades he was the leader of the propeller and helicopter departments, and rose to the rank of Lieutenant-General of Aviation Engineering Services. He has been elected an Academician of the Academy of Sciences of the U.S.S.R.—the highest scientific rank obtainable in the Soviet Union.

The second picture shows the first helicopter actually built by the TsAGI research institute—the TsAGI 1-EA of 1930 vintage. In 1928 a rotor test-rig was built which was capable of testing rotors up to 20ft diameter, driven by an engine of 120 h.p. Cyclic- and collective-pitch variations were studied on this rig and experiments finally led to the 1-EA depicted. A major rôle was played in development and flight testing by Ing. (now Professor) Cheremukhin (pronounced Cheryomukhin). The 1-EA had two



Left, the original Yuryev helicopter of 1912. Lower left, the TsAGI 1-EA of 1930. Lower right, the TsAGI 11-EA (1938)

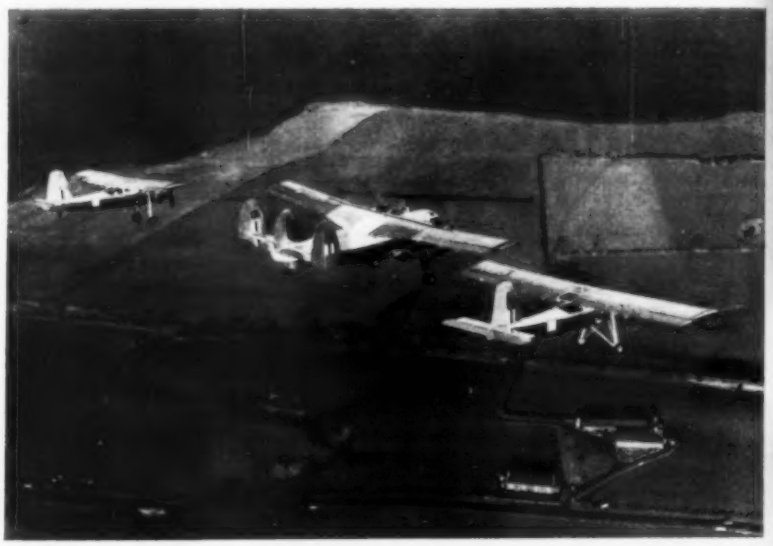
SOVIET HELICOPTERS . . .

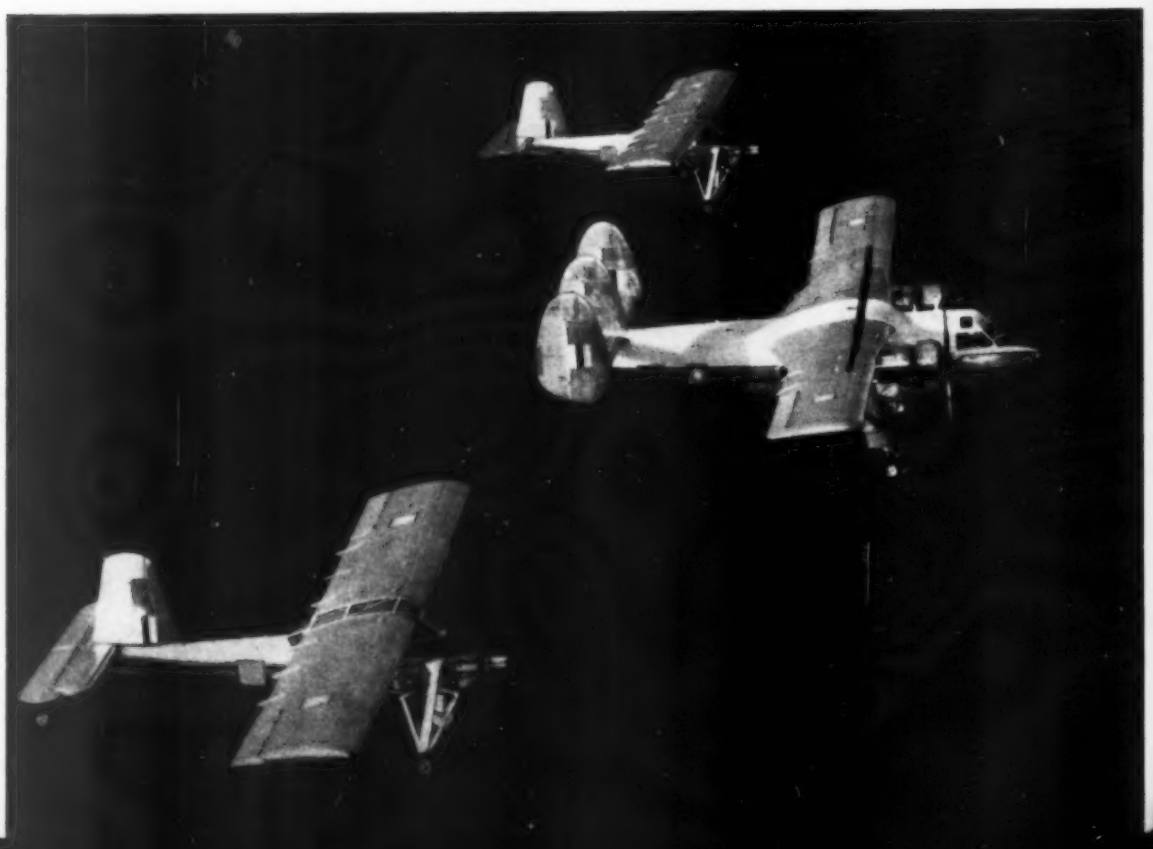
120 h.p. "Gnome-Rhone radial engines." Duplicating of the powerplants was necessitated by the poor engine reliability. In August 1932 this helicopter attained a height of 2,030ft—well above the official world record then held by the Ascanio helicopter with a height of some 60ft. The 1-EA had a four-blade rotor and a fuselage built up of tubes, carrying a compensating tail rotor at its end. The control system is said to have been that which is now familiar on helicopters of similar configuration, using collective and cyclic-pitch control for manœuvring. In the later 1930s the 3-EA and 5-EA were built. The last-named used a servo rotor for control.

The third of the small pictures shows a machine described as "a precursor of the Rotodyne"—as unquestionably it was. It is the TsAGI 11-EA, built in 1938. The designer was Aleksandr Bratukhin, one of Yuryev's most able pupils. Bratukhin participated in earlier rotor test-rig experiments and is credited with a good deal of helicopter test flying. His name later became better known in connection with the Alpha and Omega helicopters—the first post-war Soviet helicopters of which pictures were officially released for publication outside the U.S.S.R. It will be seen that the torque of the six-blade main rotor is balanced by two normal three-blade controllable-pitch propellers. These were driven by an Hispano-Suiza engine (built under licence) installed in the fuselage and connected through transmission shafts buried in the stub wing. The main rotor could be uncoupled from the engine and adjusted for autorotation, the twin screws then serving for propelling the machine. It seems that, for normal horizontal flight, the aircraft used conventional tail control surfaces, as did the later Omega. The design is remarkably clean and a speed of 170 m.p.h. is said to have been attained.

EQUIPPING THE ROYAL MALAYAN AIR FORCE

LAST April the first Scottish Aviation Twin Pioneer was delivered to Malaya as the initial equipment of the Royal Malayan Air Force. Subsequently the Malayan Government ordered three additional Twin Pioneers and four Prestwick Pioneers. All these aircraft are powered with Alvis Leonides engines. At a ceremony at Prestwick on December 29 His Excellency Tunku (Prince) Ya'acob, High Commissioner for the Federation of Malaya, formally accepted the first Twin Pioneer and two Pioneers of this follow-up order. They were handed over by the Duke of Hamilton, chairman of Scottish Aviation Ltd. Previously the aircraft had flown in formation, as seen in these pictures. On the delivery flight the Twin Pioneer is being flown by S/L. G. A. Charles, who is the Commanding Officer of No. 1 Squadron, Royal Malayan Air Force. He is accompanied by A. Cdre. N. C. Hyde, F/L. Scouness (navigator), and F/L. Parkes (engineer officer). The two Prestwick Pioneers are in the hands of F/L. Berkley and F/L. Griffin. Mr. J. Gordon, a Scottish Aviation service engineer, is travelling with the aircraft to Malaya.





Vanguard

A PRESENTATION OF BRITAIN'S NEW TURBOPROP AIRLINER

IN a few days' time the first Vickers Vanguard is to make its first flight. The following pages bring *Flight's* readers up to date with the engineering and economic facts about the aircraft. It will be seen that the Vanguard promises to be a highly efficient tool of the air transport trade.

But good engineering and good economics are not the only guarantees of acceptance, prerequisite though these two things may be. The overall design-strategy must be right, otherwise efficient economics and sound nuts-and-bolts—the "tactical" considerations—may be academic. What, then, is the strategy behind the Vanguard? There are five answers to this question.

One, the Vanguard is the first British airliner which can truly claim to possess the star quality of built-in airline experience—the quality which has ensured Lockheed's and Douglas's domination of world airline markets to date. The Vanguard is not—as was the Viscount when it first appeared—just "a good aeroplane." This is the two-dimensional view of an aeroplane's suitability for airline use; the third dimension must be added from a depth of airline operating design-experience. Vickers and Rolls-Royce, with 350 Viscounts in service, are acknowledged to possess this experience, and it has all been built into the Vanguard.

Two, the Vanguard sprang from the requirements of a most economically intransigent kind of air transport—the field of international short-to-medium stage operations. It can be said without fear of dissent that a transport designed to master the economics of intra-European routes is basically master of the denser short-to-medium stage networks anywhere.

Three, the choice of turboprop propulsion permits the Vanguard to exploit with greater margins of profit these economically difficult short-to-medium stages. (The average intra-European sector distance is less than 300 miles.) Such stages tend to be too short to permit full economic use to be made of the jet's speed; yet the Vanguard—with a cruising speed of 425 m.p.h. and above—can offer block speeds which are highly competitive with the 500-550 m.p.h. jets. Such routes are the realm of the Vanguard even in idealized air-traffic-control conditions. In the practical conditions of day-to-day operations, in which airliners have to cruise or hold as they are told, the more fuel-thrifty Vanguard may be a decisive advantage.

Four, the size of the Vanguard is a realistic attempt to provide a vehicle which can shift annually increasing traffic flows at a lower specific cost. The Vanguard represents a breakaway from the past tradition that short-haul airliners are small and long-haul airliners are big. There is as great a, if not greater, need on the shorter stages to handle growing traffic volumes by increased aircraft-size rather than by operating smaller airliners at increased frequencies. In this way the Vanguard reduces the specific cost of operation, and fares can be lowered to produce a "benevolent" generation of more traffic and a further reduction of specific costs. This is an important aspect of the Vanguard's strategy, and it is no doubt the justification for Vickers' claim that the aircraft is capable of cutting air fares by half. There is, of course, the present limitation of a fixed fare for all types of aircraft; but there are strong signs that the inevitable eventual differentiation of price between jets and propellers will come sooner rather than later. When this happens, the Vanguard's low-cost capabilities can be exploited to the full. Thus not only can the aircraft be easily topped up with bulky freight during off-peak passenger periods, but it can also be regarded as a realistic answer to the need for positive development of freight. Hitherto the cargo market has been largely developed by passenger aircraft, and the Vanguard's design recognizes this fact. For specialist air freight operators, however, a full freighter version—with a 40,000 lb payload—is offered.

Five, the Vanguard uniquely offers the operator a complete solution to one of his biggest economic problems: the economic unbalance of seasonal-type traffic. With but small penalties in speed and weight, very large underfloor freight capacity is available—enough, it is claimed, to permit full design payload to be carried with but one quarter of the seats filled.

These are the factors which should make the Vanguard not just a good aeroplane, but a good *airline* aeroplane.

Vanguard . . .

The following text is a review of the history, design and general engineering of the Vanguard. It owes much to papers written for the Society of Licensed Aircraft Engineers and the American Society of Mechanical Engineers by Mr. Derek J. Lambert, A.M.I.Mech.E., A.F.R.Ae.S., A.F.I.A.S., Vickers-Armstrongs Aircraft assistant general manager (development). This journal has previously published several major feature-articles on the Vanguard, one of which was an outline of the evolution of the original V.800 Vanguard design which was published in our issue of December 9, 1955.

THE VANGUARD has resulted from the combination of a requirement by one of the British airline corporations, B.E.A., and the desire by Vickers in 1954-5 to put their design team to work on a larger and faster successor for the Viscount. Owing to the timing of its design and the manufacture, it was possible to embody in the Vanguard all the basic knowledge derived from the original and unique turboprop experience which B.E.A. and Vickers held between them as a result of their pioneering in this field with the Viscount. Thus it is correct to claim that the Vanguard is the only real second-generation civil turbine aircraft in the Western world.

Superimposed on the Viscount experience was the background of the Valiant and V.1000. In the case of the Valiant, not only was that again unique in its field in terms of advanced and successful aerodynamic design but also in terms of practical engineering and workability. Immediately prior to the introduction of the Vanguard into the design office the Valiant had been designed, developed and produced in a time scale which, to say the least, must be described as satisfactory for such an advanced four-jet bomber. This programme made a most important contribution to the Vanguard. In the case of the V.1000, much was learnt from tackling this project although it was cancelled when the major part of the structure had been manufactured and assembled. Its structural and system-engineering problems—which were raised by what at that time was a most advanced aircraft—had been solved, although their final practical proof was frustrated. However, the Vanguard project team was fresh from tackling the V.1000 and was able to make the fullest use of what it had learnt.

It is obvious that a private venture of the magnitude of the Vanguard can be launched only by a combination of a major corporation's requirement and a strong manufacturer's objective. Nevertheless, it is in everybody's interest that the final product should have world-wide, rather than limited, appeal. For this reason Vickers examined world markets and their immense Viking and Viscount operating experience, and as a result had to differ in some respects from B.E.A.'s thinking. Perhaps one of the most difficult jobs which a manufacturer has to do at the introduction of a new design is to hold the balance between the specific demands of his first major customer, the things which he knows or feels to be the needs of a wide market; and the design effort available at the time.

There appears to be no "typical customer" upon whose needs a manufacturer can model a large civil aeroplane. Even the small group of major transatlantic carriers—all apparently with the same objective—have between them contracted for all the different basic types and sub-types of long-range turbine aircraft which are procurable; whilst out of the current production orders for the Vanguard there are already three fundamentally different structural standards.

In order to justify these basic variants from the point of view of production economics, it is necessary progressively to develop a successful—and hence saleable—line of sub-variants. Such development relies for its guidance on the knowledge, experience and operational background of the airlines themselves. It relies for its motive power on the manufacturer's strength and his ability and enthusiasm for civil aircraft. It won't result from an attitude of, "There's not much in the way of military contracts this year—let's build a civil aeroplane."

Design Concept As is well known, one of the sources of the project was the B.E.A. specification for a Viscount replacement. In October 1954 there was a call for an aircraft which was larger, faster and with a longer range than the Viscount. This stemmed from the then-current emphasis on operations to the eastern Mediterranean, where the impact of the Viscount had been particularly valuable to B.E.A. Consequently this requirement included a non-stop London - Athens operation (1,500 st.m.). As will be seen, this approach to the specification was in line with Vickers' thinking.

At the same time there was within B.E.A. another body of opinion more concerned with the pure short-haul problem. This called for an aircraft which gave all the economics of size without having any greater range than that needed for the specific job of concentrating on the very-high-traffic European routes. Such a specification required a 100-passenger aircraft with a commercial range of 500 miles (London - Switzerland), yet with excellent economics on 200-mile routes (London - Paris). This view eventually prevailed in the specification requirements, and led to a further examination of the economic implications of what in 1954 was a very large aircraft.

Traffic projections were favourable at this time. B.E.A.'s traffic had been expanding at over 20 per cent per year and, planning on only 15 per cent per year, a 100-seater would be needed as a replacement for the 47-seater Viscounts then in service. However, not all routes would yield such traffic increases, and there were some nagging doubts about the high work-capacity (passenger or freight) which would be generated by the economic utilization of such a large and fast aeroplane. Additionally there was—and still is—a great problem in the peaky nature of B.E.A.'s traffic. It was in order to solve this duplex problem that the freight holds were specified. At one step these permitted the aircraft to be operated as a pure freight-carrier at night without any modifications whatsoever, and the freight potential also enabled the aircraft to be operated economically on sectors where the passenger load by itself would not have justified Viscount-replacement operation.

Such were a few of the underlying thoughts which in April 1955 led to the B.E.A. *Viscount Replacement Aircraft Specification* from which the Vanguard emerged. The aircraft was to be a 425 m.p.h. turboprop, carrying 93 passengers over stages of up to 500 miles. The total payload was to be 21,000 lb, the operating cost 10 per cent less than that of the Viscount 802, and the aircraft was to be designed to operate from 2,000 yd runways. Additional range was of interest only if such extension did not affect the economics of the 200/500-mile band.

As has been said, Vickers were also studying the market elsewhere for the Viscount replacement. The B.E.A. size, speed and freight-hold philosophy were felt to be right; but, with eyes also on the market for a replacement for the DC-4/DC-6B, it was obviously necessary for Vickers to provide an aircraft with much greater range than the Viscount, capable of operation over long inter-continental routes with irregular traffic stops. Surveys showed that a 2,500-mile useful range would cover some 95 per cent of the world's stages and it was felt that this range could be provided without significant loss of short-haul economy.

About this time Vickers were experiencing repeated requests

from all over the world for range development of the Viscount. An important example was Capital Airlines, who, owing to wind and reserves problems, were hard put to carry the very high payloads offering with adequate fuel on certain critical sectors with their V.745Ds (then at 60,000 lb max.), although these sectors were relatively short by other Viscount operators' standards. This particular problem was solved by progressive modification to raise the take-off weight (which now stands at 64,500 lb). The origin of this development of the Viscount obviously drew greater attention to the problems associated with high traffic-densities, not only as regards limiting weights and fuel capacities, but also in the economic sense.

Accordingly a further analysis of several operators' fleet dispositions was made; and this showed that, for traffic, weather and other reasons, the majority of U.S. domestic flights were made at less than half the design range of the aircraft. A histogram from this study shows that aircraft with 4,000/5,000-mile still-air ranges were extensively employed on stages one-tenth of this length. This factor was accordingly taken into account in designing the Vanguard.

As a result of all these studies, the changes to the useful range and fuel-reserve potentials undoubtedly constitute the most significant of the variations between the basic B.E.A. specification and the final form of the Vanguard Type 951. When T.C.A. placed their order in January 1957 their useful-range requirement was even greater than the manufacturer's prediction, and resulted in further structural developments. The specification for the T.C.A. Type 952 also requested development to increase the payload to 24,000 lb, and the latest development (Type 953 and subsequent) has been to increase it further to 29,000 lb in order to provide for the growing demands of mass low-fare air travel.

Design Philosophy In approaching the actual design of a new aircraft the manufacturer is faced with a whole field of technological advances which he is told will, if embodied in his new project, result in a lighter and theoretically more efficient aeroplane. In the case of the Vanguard a careful choice had to be made between two main alternative courses. One was to embody all the latest improvements and developments, including those either completely unproven or inadequately established by service experience. The other was to design the aeroplane on the back of the world-wide experience with the Viscount, changing only those things which experience or change in requirements had shown to be necessary.

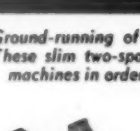
The advantages of the first course are very apparent. The salesman would be able to boast of the very latest and "bestest" without risk of being proved wrong—at least for the time being—and the design organization could sharpen its teeth for the next job on the problems encountered. If the Vanguard had been designed to break into new fields of performance, or to fill the "Blue Riband" operation of the transatlantic airlines for a decade to come, then the disadvantages of adopting the first course would have been more than outweighed by the advantages.

However, the aeroplane was intended as a workmanlike successor to, or augmenter of, the Viscount, and it was decided to work as far as possible within current experience and knowledge but to adopt all the state-of-the-art improvements which had occurred. Further, to use the thinking and hardware known to be successful in the Viscount, coupled with the development and improvement of principles known to be nearly successful. Those things which had either been a source of trouble, and which could not be solved by development, or which had been a source of customer-resistance, and could not be solved by sales-talk or engineering, were to be abandoned. This philosophy necessitated the discarding of certain principles and methods which had been used on previous Vickers aircraft, and meant that new fields had to be entered or investigated.

Aerodynamics Fundamental aerodynamic feature of a transport aeroplane is its wing. In view of the maximum cruising speed of some 450 m.p.h. and design Mach number of 0.74, it was decided to employ a wing with a gross area of 1,530 sq ft, a span of 118ft, a taper ratio of 2.75 : 1 and a section modified from NACA 63, with a t/c ratio decreasing from 15 per cent at the root to 13 per cent at the tip. For mechanical reasons it was decided to employ constant-chord flaps (as described later), resulting in compound taper on the trailing edge.

By modern standards the tyre pressure is extremely low. The size of the main gear accordingly results in substantial bulges on the undersides of the inboard nacelles, and the profile of these bulges had to be designed with particular care. Similar attention was paid to the shape of the large double-bubble fuselage, and it is significant that the addition of the voluminous freight-holds reduces the cruising speed by less than 5 kt. Extensive research

Ground-running of the Rolls-Royce Tyne engines of the first Vanguard, G-AOYW, started early in December last year. These slim two-spool turboprops drive 14ft 6in de Havilland propellers, the latter having an activity factor of 160 in later machines in order to absorb over 5,000 h.p. The intakes beneath the outboard nacelle serve a de-icing heat exchanger



Vanguard . . .

showed that the wing/body intersection could be made almost ideal for the chosen cruising-speed/Mach relationship, and no fillets were found necessary. Likewise the over-wing jet-pipe layout—dictated by mechanical and practical considerations—is extremely clean and requires no fillets.

As might be expected, Mach considerations require empennage t/c ratios rather lower than those chosen for the wing; the values adopted are 14 per cent at the root and 12 per cent at the tip and, as in the Viscount, the tailplane has 15 deg dihedral to give minimum variation of longitudinal stability with engine power. Another noteworthy feature is the selection of conical propeller spinners, affording maximum intake efficiency at high flight speeds.

Notwithstanding Vickers' advanced model-making techniques, over 75,000 man-hours were expended in the manufacture of the 22 models used during Vanguard development. Tunnel time is currently 1,500 hr, and the tempo is likely to increase as actual flight-test results require further examination in tunnels. Separate models have been employed for aerial-polarization and ditching trials.

Structural Testing It is still too early for there to be any conformity on this subject between Britain and the U.S.A., or even between manufacturers, but the Vanguard programme naturally incorporates procedures influenced by the ten years of structure-testing of the Viscount. The Vanguard will involve less testing to destruction, but greater emphasis will be placed on proof-load tests. Major investigations number three: proof tests on airframe under gust, manœuvre and other design cases, with tanks pressurized and control circuits and flaps in operation (specimens subsequently to undergo ultimate-load tests); proof and ultimate tests on a forward-fuselage specimen; and fatigue pressure testing in the stratosphere chamber at Weybridge on another forward-fuselage specimen. In addition a great number of detail structure-test investigations are in hand.

Structure *The Wing.* A main double torsion box is built up from integrally machined combination skin/stringer panels and three shear webs. To this box are added the readily detachable leading-edge sections, the aileron fairings and attachments and the flap shrouds; the flap guide-rails also cantilever from its rear face. The torsion box is manufactured in five sections: a short section spans the fuselage, and each mainplane is in two sections, with manufacturing joints at the root and just outboard of the outer nacelle. Altogether there are 54 machined skin panels, the largest starting as a billet 340in × 28in × 2in, weighing almost 2,000 lb. Upper-surface panels are to D.T.D. 5050 (high-strength alloy) and under-skins of American 24ST-4. The latter are attached by taper-head (1:13) bolts, which project about 0.03in unloaded and have the correct interference for maximum fatigue life when pulled flush. Four mainplane sections form integral fuel tanks; no fuel is carried in the fifth portion in the fuselage.

In the top surface of the inboard tank are four large access panels for entry to the two torsion boxes, and in consequence the tank ribs incorporate elliptical crawl-ways. Access to the rather shallow outer-wing tanks is by removable panels in the front and rear shear webs. The four engine-mounting longerons in the inboard nacelle are attached to the torsion box at two integrally machined ribs, which also carry the fittings for the undercarriage.

A great deal has been said of "fail safe" or multiple-load-path structures; and much of it has come from salesmen rather than from engineers—or from engineers who, in order to safeguard their livelihood, had to become salesmen. The fallacy of the multiple-load-path argument when used by the wrong people is exposed unwittingly by a major American manufacturer, who has placed two highly stressed machined forgings side-by-side and boasts that either can take the load if the other fails. A careful check would seem to indicate that the integrity of the design is such that a failure would not be exposed, other than at a major tear-down, whilst the effects of such a failure as a stress-raiser in the remaining half of the "multi" load-path gives serious food for thought.

Why, then, is the Vanguard using such a wing structure, bearing in mind Vickers' experience and satisfaction with mono-spar construction in the latest form of the art? Basically it is because of the fuel-capacity demands of a turbine aircraft of relatively high wing-loading. Bag tanks on both the Viscount and Valiant have been developed to a highly satisfactory state, and in accordance with the overall design philosophy of the Vanguard should have been retained; but it was quite impossible to obtain adequate internal capacity with them. Accordingly integral tanks were chosen, and the Viscount mono-spar, nil-stringer construction—quite unsuited to this—was abandoned.

As soon as a stringer type of wing with integral tanks was indicated, the long-term advantages of the machined-skin/stringer construction were seen, not only for the Vanguard but for future aircraft. The logical development of this thinking was the twin torsion-box, triple shear-web design (cross-section sketch, p. 74). A feature of the Vanguard wing is that not only is there the fail-safe concept for bending loads on both top and bottom surfaces, but in addition there are two torsion boxes; thus, even major damage to a shear web could still leave a temporarily workable torsion structure.

On page 76 is seen the root-joint configuration which results from the differing philosophies of the Viscount and Vanguard wing structures. Another feature is that an unpressurized wing stub has been incorporated, so that the pressure cabin is isolated from the fuel-tank end rib.

Fuselage. Flying in the same well-explored altitude band as the Viscount, and hence working to the same pressure differential, the changes from the latest Viscount standards are few. Structure is conventional, and consists in the main of channel-section frames at about 20in pitch supporting Z-section stringers to which the skin panels are flush-riveted. Both stringers and frames are continuous; and the latter, whilst basically floating, are cleated to the skin throughout. Nowhere is there more than about 100 sq in (20in × 5in) of unsupported skin. All material is Alclad, single-heat-treated, the skin being L.72 and the stringers L.73. Sheeting is Alocromed and the entire structure is painted.

Basic structural philosophy has been to obtain long life free from fatigue and, at the same time, to provide alternative load-paths wherever appropriate, together with provision for arresting cracks or ruptures which might otherwise grow too rapidly between inspection cycles. The lower left illustration on p. 74 should suggest the efforts which have been made in the field of crack-stopping and structural integrity. The thickness of the pressurized skins and their lower working stress-levels are aimed at long life, and allow the rivets to be cut countersunk (the rivets are of a 70-deg pattern, originally developed for the Valiant).

It is worth noting three basic structural changes from the Viscount. First, the complete fuselage splices are in single circumferential planes, instead of with staggered skin plating and alternately staggered stringers on either side of a frame; this eliminates the slightly obscure stress-raising potential of the staggered principle which results from the distribution of local structural stiffness. Second, the cockpit floor is not pressure-bearing and the nose undercarriage is retracted into a pressure-box let into an otherwise continuous pressure-shell (as on the V.1000). Third, the cockpit structure is an integral part of the basic fuselage; the structural surrounds for the cockpit glazing are machined from quite large forgings and it is worth noting that only five main forgings are used for the complete set of 13 windows (or 11 on the T.C.A. type, which has a redesigned direct-vision window arrangement).

In the first stage of fuselage construction the stringers, window surrounds and similar pieces are assembled to the individual panels. Most of the fuselage is constant-section, so the majority of these panels have single-degree curvature and complex stretching is avoided. These panel assemblies are then attached to the frames and door surrounds to form half-bodies of fuselage split on the centre-line (sketch, top of p. 76). The subsequent stage brings these sections together, with closing panels at the top and bottom, on to the basic floor structure which has been previously loaded into the final sub-assembly jig. Individual floor panels and beams are readily replaceable, and glass-fibre beams are used above the wing so that this portion of floor can "breathe" with wing bending. Pre-assembled nose and tail-cone structures are joined at this stage and, together with an integrally assembled centre-fuselage and wing, are mated in the final brief structural-assembly stage. In fact, only one final fuselage-assembly jig is required for each two sets of major sub-assembly jigs.

Door openings are rectangular, and the doors operate on a parallel linkage developed on the 800-series Viscount. All doors embody forged and machined surround frames, with extensive Reduxed and riveted doubling plates for a second load path. Each door has multiple claws, with over-centre locking. As shown on page 75 a new type of seal, inflated by cabin pressure, has superseded the pneumatically inflated type of the V.800/810 series. The popular elliptical window of the Viscount has been retained. The emergency-exit windows are of a revised type, held by four sprung plungers.

The double-bubble fuselage cross-section originated in a B.E.A. expressed passenger-preference for a high-wing layout, such as on the Elizabethan (Ambassador). After considerable theoretical investigation into structure-weights, aerodynamic cleanliness, undercarriage design, propeller ground-clearance, etc., Vickers made a detailed survey of the opinions of the world's major operators. Whilst most airlines tended to support the passenger-appeal feature of the high wing, there were very strong objections on other grounds. These were forcibly expressed by a sufficient number of operators to increase the reluctance to a high-wing design to the point where reluctance became refusal. These objections were associated with: ditching characteristics, and passenger evacuation in these circumstances; relative passenger vulnerability in the serious belly-landing type of accident; and the difficulty of visual confirmation by the crew of satisfactory snow clearance from the top surface of the wing while a take-off was in progress.

For the ditching argument, a survey was made of the number of important airports throughout the world in which the take-off was made over water—even though the flight might be a domestic over-land service. Not only was the total number of such flights of considerable surprise to the investigators, but the incidence of ditchings which had occurred in relatively shallow water, near to land soon after take-off, was too significant to be ignored.

On the subject of serious belly-landing accidents, Viscount experience alone had indicated the vital part which is played by the under-floor belly holds and surrounding structure in protecting the passengers from injury.

Accordingly, a high-wing layout was not adopted. Nevertheless, a number of the secondary advantages of a high wing were still demanded—such as a freight flo.. at truck-bed height, with adequate interior working depth, whilst retaining adequate propeller ground-clearance. These logical requirements effectively fixed the low-mid wing arrangement; and once the passenger-cabin floor area, and the freight-hold depth and position, had been fixed, the resulting aerodynamic and structural envelope automatically determined the freight-hold volume. Choice of a double-bubble cross-section was also effectively automatic. Once the passenger cabin width at elbow level (128in) had been fixed, together with the under-floor freight-hold depth (51in), the logical structural envelope is a double-bubble and not a circle.

Empennage and Flying Controls. Fin and tailplane structural design follows directly from that of the wing. Each of these surfaces incorporates a twin-torsion-box structure, but the skins are of conventional skin/stringer construction. The tailplane is continuous through the fuselage, and both the fin and tailplane shear webs are attached to the same three fuselage frames in an unpressurized tail-cone. Construction of the elevators and rudder is unusual, and exceedingly neat. Spanwise members are used at the leading and trailing edges, and ribs are placed flanking the hinges and at the ends of each surface. The structure is completed by pre-formed skins of sandwich construction, each panel being a Redux-bonded honeycomb some 0.5in thick. Honeycomb construction is not employed in the ailerons, which are each split into three portions to take up wing deflections.

Flying controls follow directly from the Viscount, with entirely manual operation. The short-cut method of power controls, or the compromise of power boost, were discarded after fair evaluation and having regard to operators' opinions. All flying-control surfaces are manually operated through large servo or spring tabs. Tab profile is critical, and each tab is honeycomb-stiffened. Aerodynamic balance is provided by set-back hinges on the elevators and rudder, and by Irving-type shrouded balances on the ailerons. Trimming is manual and conventional, and the tailplane is fixed. The operation of the controls through spring-tabs means that neither the ailerons nor the elevators are directly connected across the aircraft. Flight development of the Vanguard controls has been carried out on a specially modified Viscount 810.

Flaps. The Fowler-type flaps are divided into four sections on each wing, and are operated from a large hydraulic screw-jack in the starboard inner plane just behind the main torsion box. This drives all eight flap sections via a span-wise torsion shaft and cables attached to the guide-rail trolleys of the flap sections.

Take-off and landing settings are respectively 20 and 40 deg. As is usual with the Fowler pattern, nearly all the angular deflection occurs after the major part of the rearward travel has taken place. Flap angle is controlled by trolleys which run in double-tracked guide rails inside the rear nacelle-fairings; unlike the Viscount, telescopic tie-rods are not employed. Appropriate precautions have been taken to arrest the flaps, and avoid asymmetric blow-back, in the event of shaft or cable failure. An important feature of these flaps is their parallel motion, which results from the use of constant chord, rather than constant percentage-chord as on the Viscount. The geometry of a constant-percentage-chord flap results in a complex motion, which contributed to some of the early problems with the Viscount system.

Undercarriage. Of Vickers design and manufacture, the under-

The first hull, before furnishing. Interior volume above the floor is 5,690 cu ft, maximum height is 86.5in and the maximum width 128in

Vanguard . . .

carriage has simple geometry, and the A.R.B. have accepted its design to the U.S. requirement of 10ft/sec. With dual wheels, rather than a bogie, turning about one main leg is part of the design. All three units retract forwards and employ low-pressure tyres. Current tyre sizes are optional, with the lowest pressure at maximum take-off weight around 105 lb/sq in to avoid runway strength problems and to make the aircraft suitable for operation from second-class airports. Tyres, wheels, brakes and anti-skid units are by Dunlop on B.E.A. Vanguards; on T.C.A. machines the contractor is Goodyear.

Nose wheel steering is provided to ±70 deg, with a multiple damping device mounted on the top of the shock absorber for shimmy prevention. Free-fall emergency lowering in the event of hydraulic system failure is ensured by gravity and air-drag following the mechanical release of the up-locks and the fluid in the chassis jack circuits. This release is effected from the cockpit by means of a separate mechanical linkage operated by a prominent lever. This lever is also used for selection of emergency raising, in the event of a failure of the normal electrical operation of the selector valve, an alternative electrical supply being automatically provided.

The wheel brakes can be operated by either hand lever or foot pedal, and the latter automatically brings the anti-skid device into operation. Both circuits are supplied from the main hydraulic system, but each has its own reserve accumulator for use in the event of loss of main system pressure. Self-sealing couplings to an external rig permit raising or lowering of any individual undercarriage unit for maintenance purposes. In such cases it is not necessary to jack the whole aircraft. The chassis attachment has been so designed that, in the event of the conventional overshoot landing accident, the gear has a good chance of being cleanly torn off, with a minimum of damage to the basic wing structure and fuel tanks.

Powerplant The Vanguard powerplant consists of four Rolls-Royce Tyne propeller turbine engines, driving 14ft 6in-diameter four-bladed de Havilland propellers. A Rotol accessory gearbox is mounted under each engine.

Several types of Tyne will be fitted to the Vanguard. The initial brochure specified the RTy.1 of 4,020 s.h.p., but the inexorable onward march of the Derby company has long since taken even this first production engine to the level of 4,500 s.h.p. (4,985 e.h.p.), and this is almost certain to be lower than the rating of the first engines to enter service in March 1960. At 25,000ft, i.s.a., 370 kt, this engine has a cruise rating of 2,685 e.h.p. with an s.f.c. of 0.405. By 1961 the RTy.11 (otherwise known as the Tyne 2, and originally designated Stage III) will be delivered with a maximum rating of 5,030 s.h.p. (5,525 e.h.p.), with a cruise rating of 3,195 e.h.p. and an s.f.c. of 0.388. These increases in power stem largely from the acceptance of higher gas temperature, by employing improved materials and air-cooled turbine blading.

As is now well known, the Tyne is a two-spool, or split-compressor, engine, the low- and high-pressure compressors respectively having six and nine stages and being driven by a three-stage and a single-stage turbine. Air is drawn in through a perfect annular intake, which is heated by electric elements and incorporates a 46-pint peripheral oil tank. The intake struts and inlet guide vanes are heated by compressor bleed air. The engine is started by an electric starter driving the h-p. assembly. Both h-p. and l-p. assemblies drive accessories, the latter portion of the engine being geared to both the propeller-control unit and the accessory gearbox. Details of the propeller, starter and fuel-control unit will be found on pp. 69-70.

Each engine is carried behind the intake on tubular mountings, which lead back to four fixings at the firewall in a similar manner to the Viscount. Aft of this wall the nacelle is a monocoque, with four large longerons to transfer the engine loads back to the wing. As shown on page 74, the engines are mounted high and the jet-pipes pass over the wing, in order to provide adequate propeller ground-clearance. All four powerplants are interchangeable. Cowlings are of a petal type similar to the Viscount, and large access doors are provided for accessory-gearbox inspection.

Systems *Fuel System.* As already noted, all fuel is carried well outboard of the fuselage in the integral tanks formed by the double torsion-box of each mainplane. At the manufacturing joint outboard of the outer engines is a sealing rib, so that there are four distinct cells. All four are used at take-off and landing; in normal cruise each cell feeds its own engine but for long-range flying it is customary to drain the inners first. Thus it can be described as a four-tank system.

System capacity—see cut-away drawing—is 5,100 Imp. gal (6,125 U.S. gal) of either kerosine or wide-cut petrol. A socket in the port wing root provides for pressure-fuelling at 600 gal/min (720 U.S. gal) or defuelling at 200 gal/min, and a bifurcating adaptor permits two Viscount-type refuellers to be connected simultaneously. Each tank also has a gravity over-wing filler, with a total rate of 200 gal/min. Continuous fuel-heating is provided, and the tanks can be emptied through jettison pipes inboard of the ailerons.

Air-conditioning and Pressurization. Since the range of operating altitudes of the Vanguard is similar to that of the Viscount, a working maximum dP of 6.5 lb/sq in is used. The entire fuselage is pressurized, with the exception of the nose radar bay, nosewheel bay and tail-cone.

Two cabin superchargers—of the screw-compressor type, with helical intermeshing rotors—are mounted on the inboard-engine accessory gearboxes. Each draws in air through filters to deliver through primary silencers to a common supply duct in the fuselage. The supply is metered and the excess rejected through spill-valves. Full pressure can be maintained with either supercharger, and sufficient air-flow (about 2,700 cu ft/min) is provided to change the cabin air completely about 20 times per hour. The supply is led along the fuselage to the air-conditioning bay situated around the nosewheel bay. Here it is conditioned by ram-air-cooled heat exchangers, cold-air units, etc., and passed back through a large duct in the roof and into the passenger saloons.

Distribution of conditioned air differs from early-Viscount practice, in that the main flow of air is from roof to floor rather than the reverse (sketch, p. 74). This feature was introduced on 800-series Viscounts. The Vanguard air-distribution system has been further developed to incorporate a scheme for heating the walls. Conditioned air from the main roof supply duct is discharged partly into the saloon itself and partly behind the furnishing, and the latter flow heats the inter-window wall sections before entering the saloon beneath the hat racks. Tappings from the wall ducts heat the skirting panels beside the passengers' feet. Multiple-position individual cold-air outlets are also provided. All cabin air is exhausted through grills at floor level, passes around the cargo-hold linings and is finally vented overboard through discharge valves in the centre fuselage. Flight-deck temperature is selected by mixing hot and cold airflows with control independent from that for the passenger saloon.

For operation in severe climatic conditions, a closed-cycle Freon refrigerating system may be incorporated. Without this system, ground-conditioning can still be obtained from the air-cycle system by running an inboard engine and generator or by ground electrical supply. An attachment point for a ground-conditioning truck is also provided, and for ground pre-heating, a truck-mounted electric heater and fan may be employed.

Electrics. As in the Viscount, the main electrical system (Fig. p. 75) operates on 28V D.C. Power was originally to have been supplied by combined starter/generator units, but this arrangement was discarded at an early stage. The system is now energized by six variable-frequency A.C. alternators driven from the accessory gearboxes, and a Viscount-type starter is used for engine-starting.

Two alternators are driven by each outboard engine and a single alternator by each inboard engine. The 28-V D.C. power is derived from four 500-amp, 28-V D.C. transformer/rectifier units. In order to obtain four-engine reliability for the main D.C. power system, one alternator per engine is utilized to supply power to the individual T.R.U.s In addition, these four alternators supply power to their respective propeller, spinner and nose-cowl de-icing systems. The two remaining alternators (on the outboard engines) are used for tail and windscreen de-icing and de-misting, the connections being such that only one alternator supplies these loads at a time, with a manual switch to permit loads to be transferred to either alternator as required. The fully rated output of each alternator is 50 kVA at 200V.

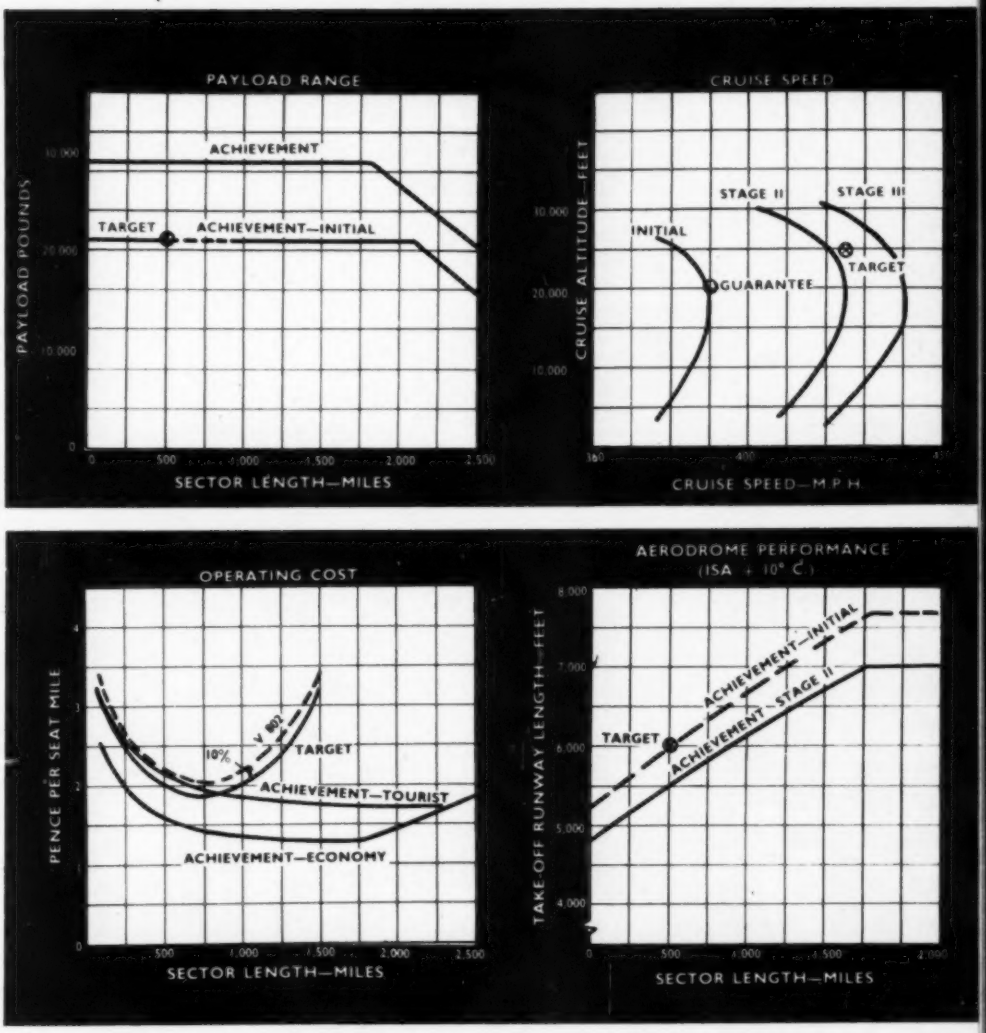
A.C. power for systems requiring 115/200V, 3-phase, 400 c/s is supplied from three inverters. Two provide the main supply, with the third acting as a stand-by in the event of failure of either of the others. Up to six 24-V batteries, giving a total capacity of 150 amp-hr, are connected in parallel to operate in conjunction with the D.C. system. The crash system disconnects the batteries from the main bus-bar.

The main electrical compartment is situated beneath, and just forward of, the wing centre section, and is accessible from a hatch under the fuselage and through the cabin floor. The batteries are mounted in this electrical bay, remote from hydraulic pipelines and components. They are completely shrouded, vented to atmosphere by cabin differential bleed and easily accessible through the hatch for rapid change-over; no special ground equipment is required. For general D.C. requirements a ground power receptacle continuously rated at 1,000 amp is installed; D.C. supplies are fed from separate sub bus-bars, so arranged that the failure of one sub bus-bar will not endanger the aircraft. Radio equipment is housed immediately ahead of the forward passenger entrance door, and the majority of aerials are flush mounted. Weather radar, with a 28in scanner, can be fitted at the nose of the aircraft.

Hydraulics. Four engine-driven pumps, mounted one on each accessory gearbox, supply the system at 3,000 lb/sq in to operate the landing gear, flaps, wheel brakes, nosewheel steering, air steps and propeller brakes.

High-pressure lines are stainless steel and low-pressure lines in light alloy. In flight, with the chassis and flaps in the retracted position, the system is automatically off-loaded. The system is designed to use either mineral-based D.T.D. 585 or Skydrol 500 fluids, provided that the appropriate seals and packings are fitted to the components. In all cases the cabin-pressure sealants are Skydrol-resistant, and other components are protected from contamination by isolation or by appropriate resistant materials. Should D.T.D. 585 be specified, all high-pressure lines in the fuselage are shrouded in mist-proof ducts and vented to the hydraulic compartment. As an additional safeguard the main electrical duct in the fuselage has been kept well clear of hydraulic lines, and the major electrical components are installed in an electrics bay completely isolated from the hydraulics compartment.

The hydraulic tank and the majority of the control valves and accumulators are installed within the hydraulic compartment behind the wing torsion box in the fuselage. Maintenance and trouble-shooting are simplified by this concentration of components in a properly designed compartment, and all pipe-lengths are minimized. The compartment is readily accessible from under the fuselage, but is carefully sealed off from the pressure cabin. A small airflow from the freight hold ensures the safe disposal of hydraulic mist. An auxiliary electrically-driven pump is situated in the hydraulic compartment for flap-emergency operation, airstep operation and charging the brake system for prolonged towing and ground handling. The isolation of the bay is such that emergency topping-up—with coffee, for example—is not possible, but the free-fall undercarriage and emergency flap-lowering system look after the safety provisions. At an isolated airfield the hydraulic system can be recharged by hand, although it is designed for filling from a pressure-socket.



The curves above emphasize graphically how far the Vanguard has exceeded its original promises. All future Vanguards will be to the V.593 (Mk 2) standard, additional power and structural strength being provided to allow for greater speed, increased payload or both

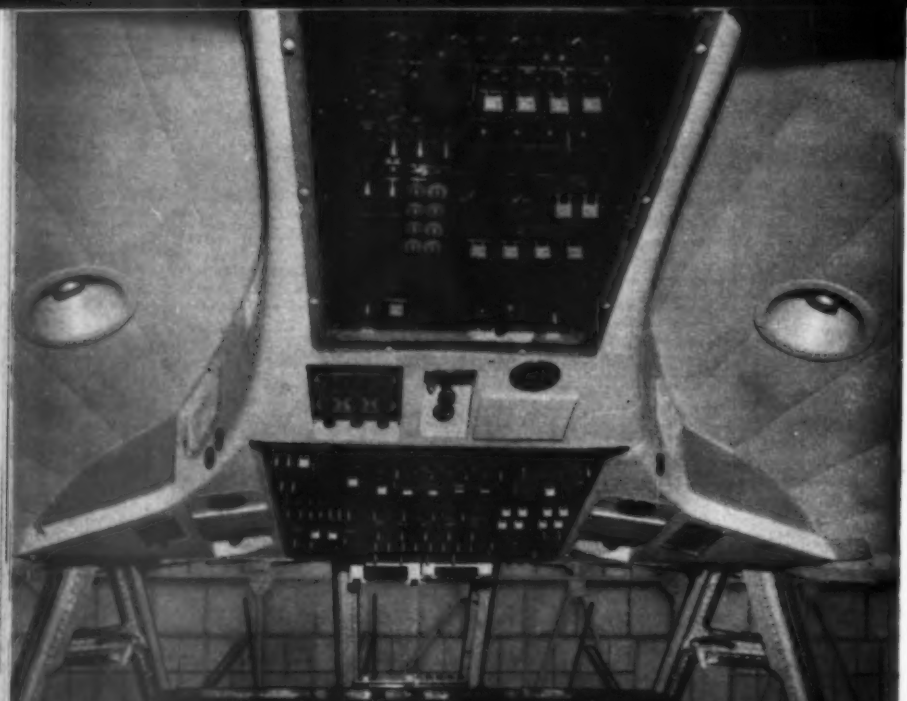
Ice-Protection. Wing leading edge de-icing follows directly from Viscount experience, although the heat exchangers are more readily removable. A hot-air system is employed, fed from the ram-air and exhaust-gas heat exchangers located in the outer nacelles with an interconnecting cross-feed pipe to cater for the engine-failure case.

As an inordinate length of ducting would have been needed to supply hot air to the tailplane and fin leading edges, an electrical cyclic system is used on these surfaces. The cockpit glazing panels are of the electrically heated Nesa or Triplex gold-film type, the three panels in front of the pilots being de-iced and the remaining panels being de-misted at a lower current density. Engine nose cowlings, propeller blades and spinners are electrically de-iced. Particular attention has been paid to the elimination of fuel icing. The fuel supply to each engine, just upstream of each engine-driven backing pump, is prevented from falling below +5 deg C by the automatic circulation of warm engine oil on its way to the oil cooler.

Design for maintenance Recently a major, and by no means uncritical, customer-airline introduced a team to Weybridge for the purpose of, among other things, criticizing such maintenance aspects of the Vanguard as they felt did not measure up to their standards. It is emphasized that the object of the team was to criticize and not to compliment. It would be idle to suggest that they did not find some matters which they felt worthy of comment, but it was extremely gratifying to find that, in a volume of grumbles about many things, their criticism of the design for maintenance, when fully explored, was limited to the following major items: access into certain areas of the tailplane, other than by inspectroscope; access in the flap false-work area at the trailing edge of the wing (which criticism was subsequently shown to be almost completely unjustified); and criticism of the integrated engineering and installation of the air-conditioning components in the forward end of the forward under-floor freight hold.

In the first case the criticism of such accessibility is inherent in multi-load-path structure, particularly of low thickness/chord ratio, and it can be overcome only by a multiplicity of access panels. Modern anti-corrosion protection techniques, design knowledge and the principle of fail-safe itself, all tend to limit the need for frequent detailed inspection in such areas. The cry of the maintenance engineer for access panels seems to ignore the current and anticipated advances in X-ray technology and the fact that such inspection should justifiably be carried out by adequate instruments—such as inspectroscopes and X-ray—rather than by flash lamps and dentist's mirrors.

No comment is necessary on the second part of the criticism, but the third part concerns an area in which probably the maximum equipment-concentration occurs. Trial runs have proved that any unit of the air-conditioning system here can be removed without removing other components; the entire ducting can be removed in 30 min, largely through the use of quick-disconnect clamps, and a monorail has been installed to permit heavy air-conditioning units to be transported from their *in situ* positions to the freight door. The deep under-floor compartment greatly



The Vanguard's neat and spacious flight deck is going to be immensely popular

Vanguard . . .

enhances the accessibility of all fuselage services and control runs, as well as the localization of the electrics and hydraulics compartments. Direct access from under the aircraft nose is available to the rear of the pilots' instrument panels.

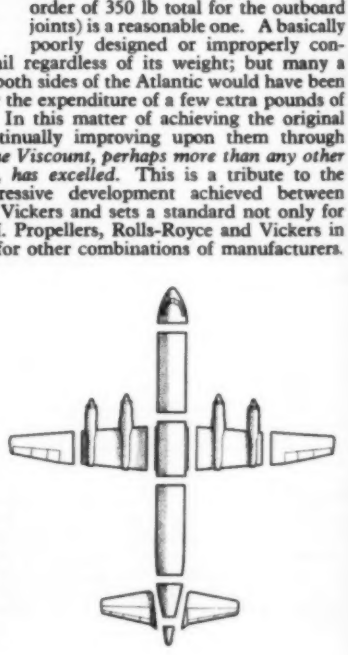
In order to design for satisfactory maintainability, each designer must at all times be fully aware of the maintenance engineers' problems, and do his best to minimize them. A successful manufacturer's strength in this respect lies in his ability to avoid major errors, and to have an organization which can rectify minor ones as soon as they are exposed.

Some additional features incorporated to ease maintenance are now listed (and any engineer familiar with the Viscount will see that notice has been taken of his comments): wing, tailplane and fin leading-edges are readily removable and replaceable in sections, engine control-runs being accessible in the leading-edge of the wing; the aileron shrouds are hinged on the under-surface throughout their length, providing ready accessibility for inspection, repair or attachment of the sealing curtain during aileron assembly; each aileron is split into three individually removable sections; the freight door and cabin-sealing nibs on the door sills are readily replaceable, as they are vulnerable to damage; special efforts have been made to permit rapid replacement of the floor panels in the immediate vicinity of the main cabin doors, and in the freight holds where damage is likely to occur; for optimum ground manœuvrability, the nose-wheel can be rotated through the full 360 deg when a towing arm is attached, without the need to disconnect torque-links; the use of peening or prick-punching for bolt locking has been abandoned, in favour of stiffnuts.

Airline Engineering. The location of manufacturing joints (below), and the consequent size of the basic structural elements of an aircraft, is a very important factor. To an increasing extent, the relative repairability of different types is a matter of great interest to the insurance companies. Once they appreciate the fact that a particular ground-handling accident on one large aircraft results in a bill for, say, £10,000 and on another aircraft in the same class £100,000, the premiums are likely to vary in proportion.

To achieve good airline engineering it is essential to face up to the necessary weight increases sufficiently early in the design to ensure that adequate performance is achieved in the end-product.

In Vickers' view, the weight-penalty of the Vanguard's wing joints (of the order of 350 lb total for the outboard joints) is a reasonable one. A basically poorly designed or improperly conceived aeroplane will fail regardless of its weight; but many a successful aeroplane on both sides of the Atlantic would have been even more successful for the expenditure of a few extra pounds of weight here and there. In this matter of achieving the original design targets and continually improving upon them through years of development, *the Viscount, perhaps more than any other aeroplane in the world, has excelled.* This is a tribute to the co-operation and progressive development achieved between Rotol, Rolls-Royce and Vickers and sets a standard not only for the combination of D.H. Propellers, Rolls-Royce and Vickers in the Vanguard, but also for other combinations of manufacturers.



This sketch indicates the manner in which the entire airframe has been subdivided in order to minimize the cost of repairing structural damage. Comments on this policy appear in the column of text above

On this page and overleaf are brief descriptions of many of the more interesting accessories which have been developed for the Vanguard by sub-contracting companies. The total list of companies involved in this aircraft runs to many hundreds of names.

Accessory drives *Rotol Ltd., Gloucester*
Each of the four engines has a Rotol drive and accessory gearbox. The drives are of the double universal-joint type, axial movement being accommodated by the serrated input shaft. Each gearbox comprises a casing in high-strength light alloy with a front cover containing trains of spur-gears and drives to the various accessories. The final drive to each accessory is provided by a quill incorporating a safety shear-neck which protects the gearbox from damage should the accessory seize. Each gearbox incorporates a Dunlop propeller-brake unit; these disc brakes are operated by the main hydraulic system and are energized when the engine concerned is shut down and an aircraft exit door is opened. The gearboxes incorporate a gear-type oil pump feeding jets playing on all gears, drives and quills; oil is also fed to the cabin blowers and main alternators.

Alternators *Rotax Ltd., Willesden Junction*
Electrical power is supplied by six alternators, four coupled to transformer/rectifier units and two employed solely for de-icing (see diagram on p. 76). Each alternator has a rated output of 50 kVA (0.98 p.f.) of 208 V 3-phase current, the frequency being 325 c/s at 6,500 r.p.m. and 490 c/s at 9,800 r.p.m.

Autopilot *Smiths Aviation Division, London*
Standard autopilot for the Vanguard is the Smiths SEP.2, which is installed with I.L.S. and V.O.R. coupling, auto-elevator trim, height lock and airspeed lock. In addition, the B.E.A. aircraft will be fitted with the Smiths Flight System. Smiths equipment has been specified for the T.C.A. V.952, but the individual types of instruments are still being considered. Auto-pilot for the V.952 will be by the Collins Radio Company of Canada Ltd.

Backing pumps *The Plessey Co. Ltd., Ilford*
Even with tank booster pumps inoperative and at extreme altitude, fuel feed to the main fuel pumps is held at the required pressure by B.P.34 backing pumps. These are four-vane, positive-displacement units, incorporating relief and disc-type by-pass valves, and with double carbon face seals on the drive shaft. Weighing 4.1 lb, each B.P.34 can deliver 600 gal/hr at 3,000 r.p.m. with a delivery pressure 25 lb/sq in above the inlet.

Blowers *Plannair Ltd., Leatherhead*
Air circulation and air-cooling of equipment is handled by four types of Plannair blower. Largest is the 9in cabin recirculation fan, which at 7,900 r.p.m. has a capacity of 1,280 cu ft/min against 15½in w.g. The blower has a continuous rating, and unique self-cooling features include an internal recirculation fan for the totally enclosed motor.

Cabin air compressors *Sir George Godfrey and Partners Ltd., Hanworth*
The Vanguard is the first aircraft to use the new Godfrey/SRM compressor which employs intermeshing helically-lobed rotors. The Vanguard unit is the Type 175 Mk 2, with a bifurcated intake and a central branch serving a controlled by-pass. The delivery manifold is bolted to a rectangular opening at the drive end of the casing. One of these compressors is driven by each inboard engine. The complete unit weighs about 127.5 lb, and at the normal operating speed of 10,000/11,500 r.p.m. delivers 50 to 75 lb/min at 30,000ft.

Cold air unit *Sir George Godfrey and Partners Ltd., Hanworth*
In the air-conditioning system a Godfrey CT-8 Mk 1A cold air unit is employed, this being an air-cycle refrigerator of the turbo-compressor type operating in conjunction with a ram-air-cooled intercooler. The inward-flow radial turbine and the centrifugal compressor are both overhung on the ends of a shaft rotating at 28,900 r.p.m. The space between the two wheels forms an oil sump and great care is taken to ensure that oil-contamination of the airflow cannot occur. The CT-8 weighs 51.75 lb and has a rated mass-flow of 200 lb/min.

Contactors *The British Thomson-Houston Co. Ltd., Coventry*
A wide range of equipment is supplied by B.T.H., four examples of contactors being illustrated above. Switchgear for the D.C. circuits ranges from small, manually operated and thermally tripped circuit breakers rated at from 6 to 35 Amp up to large 1,000-Amp magnetically operated and held contactors and 500-Amp reverse-current protecting circuit breakers. For the 200-V, three-phase, 400 c/s supply there are further contactors (one of the largest is seen in the centre, rear, of the picture), including latched, magnetically held and changeover units with nominal ratings from 10 to 150 Amp and capable of rupturing ten times the nominal current at up to 70,000ft altitude.

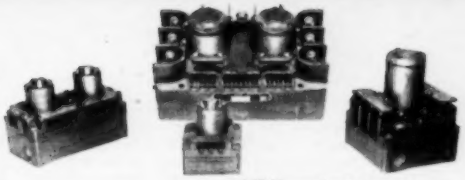
Cyclic switch *Austinlite Ltd., Crawley*
A special cyclic switch is employed to control the Napier Spraymat de-icing system (*q.v.*). The specification demanded a dwell of either 10 or 20 sec on each of the 13 sets of three-phase contacts; thus there are 39 available single-phase outlet terminals for connection to the mat system. The line current is 400 c/s, 20 V, 60 A per phase. Two motors operate through a differential to a gearbox which drives through a ratio of 25,000 or 50,000:1.

Fault warning *Page Engineering Co. (Sunbury-on-Thames) Ltd., Sunbury-on-Thames*
A centralized fault-warning system provides flashing warning of any system-malfunction and isolates the fault by an illuminated indicator adjacent to the appropriate system switch. The flashing indicators cease to operate when cancelling or muting action is taken, but the fault remains illuminated and registered until rectified. Cyclic systems have time-delayed warnings so that false alarms are not given on initial operation.

Fire-protection *Graviner Manufacturing Co. Ltd., Colnbrook*
The fire-detection system is based upon that of the Viscount, using Firewire. A number of new fittings are used to simplify engine servicing and to minimize accidental breakage. The Firewire is so fitted as to cover the zones of the engine compressor, turbine, accessory gearbox and drive, and to monitor the wheelcase breather for internal engine malfunction. The extinguishing system is so arranged that, although bottles from an adjacent engine are used for a second shot, both discharges give an identical concentration.

Fire-protection switch *Cathodeon Ltd., Cambridge*
From the Type 3066 (Viscount and Britannia) unit has been evolved the Type 3126 frangible switch for energizing the fire-protection systems under crash conditions. The new switch is mounted in the Vanguard's nacelles and fuselage; new features include dual circuits (permitting simultaneous use in more than one alarm system) and a test feature which permits the switch to be operated without breaking the envelope.

Flight-deck temperature control *Gloster Aircraft Co. Ltd., Gloucester*
Responsibility for the control of flight-deck temperature has been assigned to Gloster's Technical Developments Division who provide a mixing valve, bimetallic control unit, pressure control, solenoid override unit and pilot's controller. The mixing valve governs the proportioning of the supplies of hot air (up to 15 lb/sq in gauge) and cold air (normally at less than 0.2 lb/sq in gauge). This valve is a double-diaphragm unit, the main spring-loaded diaphragm being operated by the temperature control circuit and the second, free diaphragm providing an independent circuit for the pressure override and the solenoid override.



B.T.H. contactors

Flow control (cabin-air) *Normalair Ltd., Yeovil*
The mass-flow control receives a pneumatic signal from the metering duct and passes an electric signal to the spill-valve actuators, the latter being special A.C. units to permit the valves to be synchronized exactly.

Flowmeters *Elliott Brothers (London) Ltd., London*
A comprehensive system weighing 46 lb provides pointer presentation of the instantaneous fuel consumption of each powerplant and the aggregate consumption since the start of the flight. The four amplifiers each comprise a transistorized pre-amplifier and a magnetic output stage, together with 400 c/s power supplies and current for exciting the transmitter potentiometer and the motor tachometer/generator in the indicator. The transmitter signal is fed into the amplifier as a velodyne input, so that the motor r.p.m. is proportional to instantaneous fuel consumption and the number of revolutions of the motor shaft is proportional to the aggregate fuel consumed. Maximum error of the system is within 50 lb/hr over the range 200 to 3,000 lb/hr.

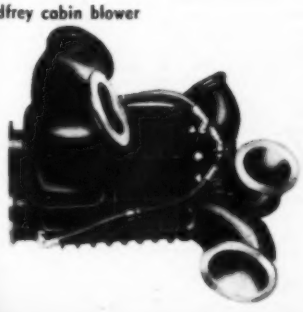
Fuel booster pumps *SPE Co. Ltd., Slough*
Fuel is pumped from the integral tanks by SPE.402 booster pumps, each rated to deliver 400 Imp. gal/hr at a minimum delivery pressure of 5 lb/sq in when operating on 26 V D.C. current. Each pump is installed within a housing which permits ready removal and replacement of the pump without draining the tank. No external connections have to be made on installation; a central electrical fitting engages with a permanent connection in the tank housing, and a continuation of the tank volute in the housing aligns with the outlet of the pump itself. Each SPE.402 weighs 4 lb.

Fuel control units *Joseph Lucas (Gas Turbine Equipment) Ltd., Willesden Junction*
Each engine incorporates a combined control unit consisting of a low-pressure filter and a simple flow-control similar to that employed in the Dart. Unlike the C.C.U. for the Viscount engine, the Tyne unit embodies three throttle valves (one forward, one reverse and one to control acceleration from ground to flight idling) together with the necessary mechanical linkages for their operation and co-ordination from a single cockpit lever.

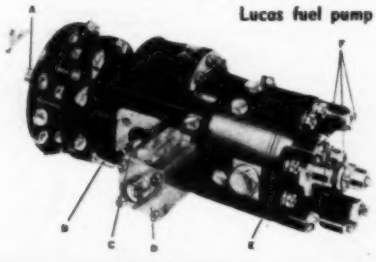
Fuel pumps *Joseph Lucas (Gas Turbine Equipment) Ltd., Willesden Junction*
Each Rolls-Royce Tyne turboprop incorporates a Lucas MGBB-series fuel pump. At a rated speed of 4,000 r.p.m. the MGBB has a rated delivery of 438 Imp. gal/hr at a delivery pressure of 2,000 lb/sq in. Items A to F in the photograph are, in order: quill shaft; maximum-flow adjusting screw; pump outlet; constant-flow valve; overspeed control cover; and alternative air-bleed plugs.

Heat exchangers *Delaney Gallay Ltd., Cricklewood*
De-icing along the leading edge of the mainplane uses air heated by passage through exhaust-gas heat exchangers. Each is a stainless-steel, cross-flow primary surface unit, with a matrix formed from 4,738 tubes of 0.004in stainless-

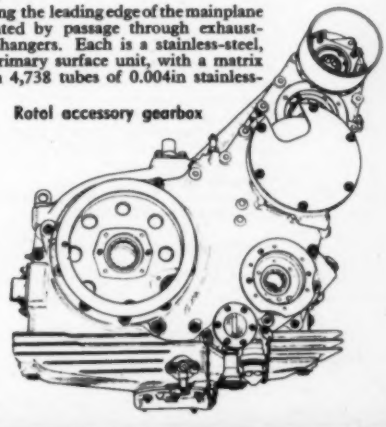
Godfrey cabin blower



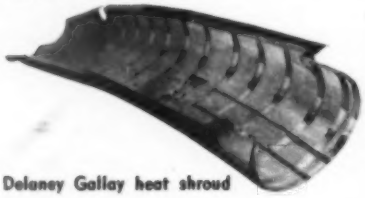
Lucas fuel pump



Rotol accessory gearbox



steel. A three-piece baffle is positioned centrally between the collector plates by 30 spacer tubes. Top and bottom end panels are double-skinned, with cooling air passed between them. Exhaust gas passes between the rows of tubes and the de-icing ram air flows through the tubes themselves. A shutter assembly seals off the duct to reduce drag when de-icing is not in use, and a temperature-sensitive element actuates a flap in the jet pipe to control the gas flow. The complete unit measures 26 × 19.5 × 18in and weighs 97 lb.



Delaney Gallay heat shroud

Heat Shrouds *Delaney Gallay Ltd., Cricklewood*
Delaney Gallay believe the Vanguard jet-pipe heat shroud to be the largest in production in the world. It is over 13ft long and 3ft wide, and provides 49 sq ft of insulation for a weight of 34.5 lb. Its function is to protect the wing and integral tankage from the heat of the jet-pipes, and also to act as a gutter and firewall to obviate damage due to wet starts. The construction comprises a layer of silica-insulant Thermoflex RF.300, sandwiched between sheets of 0.004in stainless steel dimpled on the cold face and corrugated on the hot.

Hydraulic pumps *Lockheed Hydraulic Brake Co. Ltd., Leamington Spa*
Equipment comprises hydraulic pumps, cut-out valves and accumulators; in addition, an electric selector valve provides push-button operation for the undercarriage. The pumps themselves comprise two Mk 8 pumps, each with a rated delivery of 6 gal/min, and three Mk 9 pumps, with a rating of 3 gal/min.

Ice protection (tail unit) *D. Napier and Son Ltd., Acton*
Protection of the tail unit is effected by the Napier Spraymat electrical system. The leading edges are divided into ten detachable sections (three on each tailplane and four on the fin) and there are 13 cyclic areas separated by continuously heated leading-edge and chordwise breaker strips. The total electrical load is 17.6 kVA continuous, plus 15.7 kVA cyclic, and all the circuits are balanced three-phase 208 V loads. The total protected area is 124 sq ft and "Stoneguard" protective finish is applied to the leading edge.

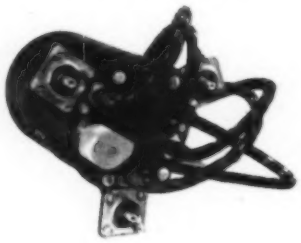
Intake ice-protection *Dunlop Rubber Co. Ltd., London*
From Dunlop's Aviation Division in Coventry come thermal de-icing mats for the annular Tyne intakes. Each mat comprises electric circuits sandwiched between layers of glass-fibre applied directly to the metal intake itself. The circuits are so arranged as to give maximum temperature in the most vulnerable regions, and they operate at over 225 deg C. The mats are protected by electro-formed metal sheaths applied to the outer covering.

Inverters *The Plessey Co. Ltd., Ilford*
Standard invertor is a 3-kVA unit of a new type with very high power/weight ratio. From a D.C. input between 25 and 29 V the invertor provides a three-phase output at 200 V, 400 c/s, with any power factor between 0.8 lagging and 0.95 leading, for serving instruments, radar and associated equipment. Each complete unit weighs less than 60 lb, can operate at full load in ambient conditions from −30 to +45 deg C and holds output voltage within ± 2½ per cent and frequency within ±3 per cent. These close tolerances are maintained by two control circuits, voltage being held by a carbon-pile regulator with compounding transformer, and frequency by a centrifugally operated carbon governor of novel design.

Microswitches *Honeywell Controls Ltd., Greenford*
Six basic types of microswitch are fitted as standard: V3-1 high-capacity, single-pole, double-throw switch rated 30 V D.C., inductive load 10 A at sea level or 6 A at 50,000ft, 0.25 oz; 1 EN-N14 potted environment-proof double switch weighing 2.5 oz; 1 SE-N7 and N8 sub-miniature rubber-sealed, aluminium-potted single-pole (normally closed), rated 3 A at sea level or 2.5 A at 50,000ft, 0.5 oz; 1 HS 6 hermetically sealed double-pole, inductive load 10 A at 30 V, 1.5 oz; and 4 HS-N7 hermetically sealed with potted leads, with same rating and weight at 1 HS 6. A total of 61 of these switches are fitted in circuits for chassis indication, flaps and powerplant ice protection.

Oxygen masks *The Walter Kidde Co. Ltd., Northolt*
For B.E.A. Vanguard 951s a crew emergency oxygen system is standard equipment. Gas is stored at 1,800 lb/sq in in a 750-litre bottle which feeds a flight-deck ring main. The latter supplies four mask stowage and control valve units, three flush in the roof and the fourth sunk into the navigator's working top. Each contains a reducing valve which, when the control knob is switched to the "on" position, feeds oxygen at a fixed rate to the mask, the latter being ejected from its housing by the same action. Unusual features include the stowed head harness and the use of a combined oxygen/microphone lead.

Panel lighting *Thorn Electrical Industries Ltd., Enfield*
The Plasteck system of instrument-panel lighting employs red light of a controlled wavelength diffused through an acrylic-plastic sheet with opaque surface layers engraved to provide the required legends and inscriptions.



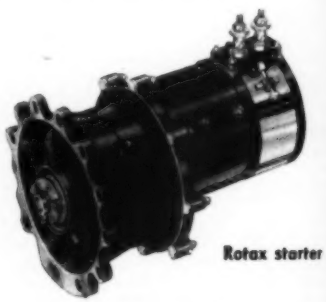
Normalair pressure controller

Pressure controller *Normalair Ltd., Yeovil*
The latest type of Normalair multi-valve pressure-control equipment is fitted to the Vanguard cabin-air system. The Type H controller works in conjunction with six identical discharge valves; the latter operate in parallel to regulate the air discharge and act as safety and inwards-relief valves. The parallel disposition of these valves, and their improved design, considerably reduces back-pressure and virtually eliminates surging. Control is completely automatic, aircrew participation being limited—except in emergency—to choosing the altitude at which control is to start and finish. Total system weight is 53 lb.

Propellers *de Havilland Propellers Ltd., Hatfield*
For the Vanguard a completely new design of propeller has been evolved, representative of the very latest techniques and embodying every modern refinement. Each propeller has a diameter of 14ft 6in, and is driven via a 0.064 : 1 reduction gearing which restricts tip Mach number to 0.82 at a typical cruising speed with the Tyne 1. The conical spinner, which incorporates electro-thermal de-icing, has a profile giving maximum efficiency at the annular intake to the engine. The propeller has four blades, which are solid forgings in high-strength aluminium alloy. The standard propeller for the V.951 Vanguard has an activity factor of 138, but a 160 activity factor propeller, with the same hub, will be incorporated in the later and heavier Vanguards in order to take full advantage of the power development of the Tyne. The propeller is controlled by a hydro-mechanical system operating on engine oil (Esso Aviation Turbo Oil 35). The following safety features are incorporated: two independent means of manual feathering; automatic hydro-mechanical drag-limiting control, sensitive to engine torque; automatic hydro-mechanical pitch locking, responsive to loss of control pressure or propeller overspeeding; automatic hydraulic pitch locking, responsive to loss of control pressure; a mechanical flight-idling stop; a secondary electro-hydraulic flight-idle safety stop; and a Beta-control hydraulic stop. Each complete propeller and associated systems weighs approximately 1,096 lb. Blade section is an NACA Series 16 and estimated take-off thrust with the Tyne 1 at 100 kt is 7,500 lb.

Propeller alternator *Rotol Ltd., Gloucester*
Each engine carries a Type (c) SNA/19 alternator to serve the propeller synchronizing and synchrophasing system. The SNA/19 consists of a shaft-mounted permanent-magnet rotor inside a three-phase coil-wound stator. Secured to the open head of the case is an end-frame incorporating a sprung plunger which, when the alternator is installed, engages with a slot in the rotor assembly to ensure that the phase output is pre-aligned in accordance with the requirements of the synchrophasing units. The alternator generates three-phase, 45 c/s current at 19 V at 2,700 r.p.m.

Sensing instruments *Sangamo Weston Ltd., Enfield*
One of the special instruments developed for the Vanguard is a tail-unit de-icing fault detector, incorporating a resistor element and indicator. Other instruments sense the temperatures of the leading-edge of the wing, turbine gas, fuel, outside air and cabin, as well as hydraulic and brake pressures.



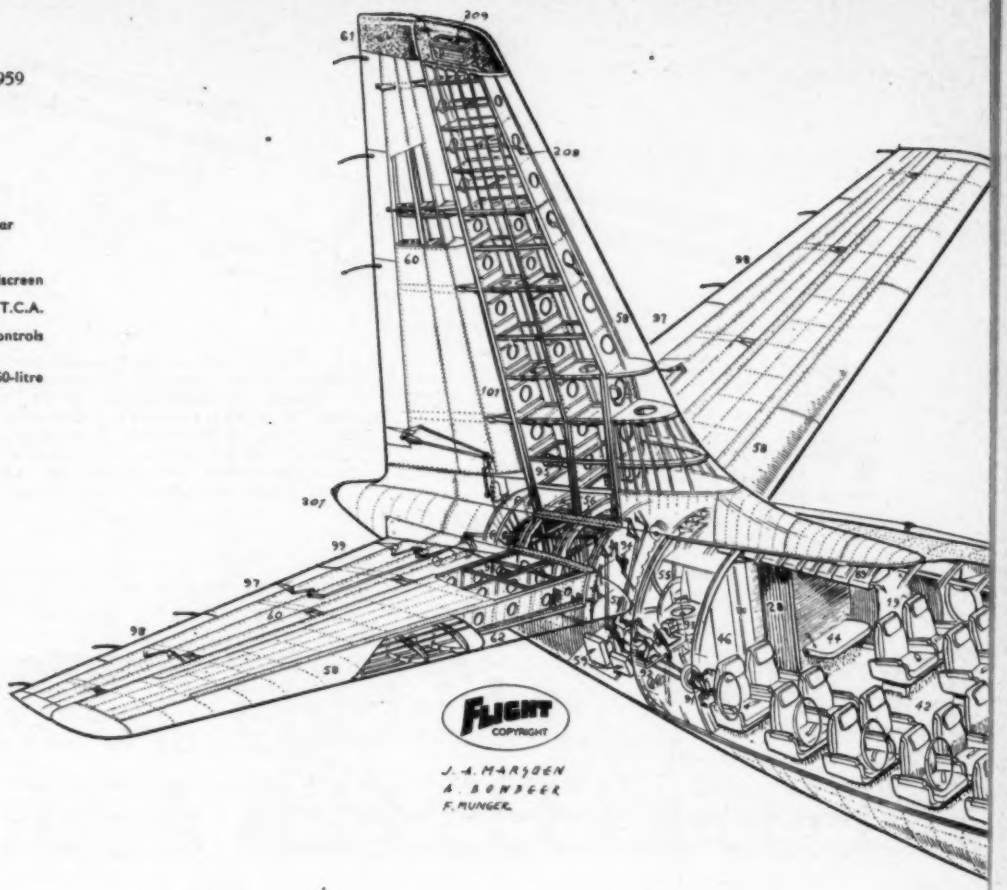
Rotax starter

Starters *Rotax Ltd., Willesden Junction*
Each Rolls-Royce Tyne engine is started by a Rotax electric starter geared to the high-pressure spool. These starters are 28 V D.C. machines with a 60-second rating of 17.2 h.p. Rotax also supply the overspeed relay and engine-starting resistor.

Turbo-fan *Sir George Godfrey and Partners Ltd., Hanworth*
The AFT-1 Mk 1 is an axial-flow fan driven by an engine-bleed turbine. The fan draws air over the heat exchangers of the air-conditioning system when the aircraft is on the ground. The unit weighs 40.25 lb, operates at between 14,400 and 16,500 r.p.m. and has a fan flow of 316 lb/min (5,900 cu ft/min), the turbine consuming 53 lb/min of air at 30 lb/sq in which is added to the fan delivery.

Vapour-cycle cooling *Normalair Ltd., Yeovil*
A complete Normalair vapour-cycle cooling system is available as an optional extra. Its function is to provide cabin cooling when the aircraft is stationary with engines stopped or when taxying at low r.p.m.

Water-extractor/silencer *Sir George Godfrey and Partners Ltd., Hanworth*
In the air-conditioning system a WE-150 Mk 1 water-extractor/silencer is used to remove free moisture from the cabin-air supply; it incorporates a hot-air by-pass duct and a silencer that attenuates the noise originating from the cold-air unit. Free moisture is coalesced into large drops on the downstream side of coalescer gauzes; the droplets are then carried into the collector, deposited on vertical tubes, drained into a sump and finally discharged through a restrictor which minimizes air-pressure losses. The complete unit weighs 78 lb and is some 56.5in long.



Fuselage

1 Ekco E.152/24 weather radar
2 Upward-hinging radome
3 Three windscreen wipers
4 Front pressure-bulkhead
5 Electrically heated windscreen panels
6 D.V. panel (single panel on T.C.A. aircraft)
7 Access panel to underfloor controls
8 Nose-undercarriage box
9 Circuit-breaker panels
10 Emergency oxygen, 750-litre bottles
11 Taxying lamp
12 Pressure head
13 Static vents
14 Radio racking
15 Provision for additional racking
16 Galley service and emergency-exit door
17 Windows 26in by 19in
18 Emergency-exit windows
19 Emergency-exit doors
20 Interlinked upper and lower freight doors, 66in by 46in
21 Forward freight hold, 750 cu ft
22 Aft freight hold, 610 cu ft
23 Freight hold lighting
24 Access to electric inverters, T.R.U.s, master gyro and toilet cooling air
25 Six batteries for 28 V system
26 Stressed floor panels
27 Galley
28 Coat stowage
29 Extended air-steps
30 Forward passenger door, 73in by 42in
31 Aft passenger door, 73in by 42in
32 Retracted air-steps
33 Air-steps hydraulic jack
34 Air-steps folding cam-track
35 Door-opening linkage
36 Steward's remote door control
37 Parallel-linkage hinges
38 Hyd aulica bay, access from underneath
39 Hydraulic header tank
40 Hydraulic recupera.ors
41 External door release
42 Seat-pitch in this area 36in in 96-seat configuration
43 Seat side-attachment anchorages
44 Tip-up steward seat (two portable oxygen sets under)
45 Main water tankage
46 Toilets (total four)
47 Toilet servicing
48 Glass-wool insulation
49 Steward call-panel
50 Escape-rope stowage
51 Access ladder to freight hold
52 Anti-glare blinds
53 Supernumerary crew-seat
54 Pilot sun-blind
55 Aft pressure bulkhead
56 Main empennage frames
57 Tailplane attachment points
58 Electro-thermal (Spraymat) de-icing
59 Fuse and circuit-breaker panels for 58
60 Honeycomb-stabilized skin
61 Dielectric tip
62 Detachable leading edge

Cabin Air System

63 Positive-displacement cabin blower
64 Ram-air supply to 63
65 Primary silencer
66 Blower spill valve
67 Silencer for 66
68 Main cabin-air delivery
69 Blower-delivery relief valve
70 Ground air supply point
71 Ram air to secondary cooler
72 Secondary cooler (primary to port); cold-air cycle
73 Ground circulating fan
74 Cold air unit
75 Silencer and water-extractor
76 Non-return valve, mixing valve and booster fan
77 Unpressurized-flight valve
78 Recirculating air duct
79 Recirculating fan
80 Recirculating air silencer
81 Hot air to 76
82 Cold air to 76
83 Conditioned (warm) air
84 Cold-air duct to individual outlets
85 Individual cold-air outlets, sliding along hat racks
86 Wall-heating cells
87 Air extraction to freight holds

Control Systems

88 Underfloor pedal linkage
89 Push/pull control tubes
90 Control-tube swinging brackets
91 Control-run gland box
92 Elevator autopilot servos
93 Rudder autopilot servos
94 Elevator trim
95 Control-lock cylinders
96 Trim cables
97 Spring tab (biassed for trim on aileron)
98 Geared servo-tab
99 Trim tab
100 Anti-upfloat unit (see detail on p. 74)
101 Sealed-balance control surfaces
102 Inspection panels in upper and lower surfaces
103 Engine control runs

Wing Structure

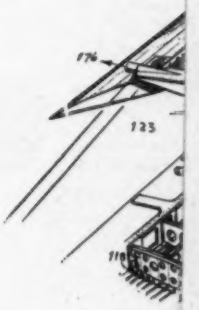
104 Centre torsion box (dry)
105 Machined wing/fuselage attachments
106 Butt-strap and web plates for centre-section/inner-wing joint
107 Butt-strap at inner-wing/outer-wing joint
108 Detachable tip unit
109 Torsion-box front web
110 Torsion-box rear web
111 Torsion-box centre member
112 Termination of centre web
113 Machined box-closing ribs
114 Tank-inspection panels
115 Machined, integrally stiffened skin, 54 panels
116 Four panels top and bottom in inner wing
117 Three panels top, four panels bottom, in outer wing
118 Multi-bracket rib/skin joint (see detail on p. 76)
119 Leading-edge attachment points
120 Manholes for access to interior
121 Forged fittings for nacelle longerons
122 Boundary ribs to jet-pipe bay
123 Aileron bay
124 Access panel to accessory bay

Flaps

125 Fowler area-increasing flaps (one section removed)
126 Flap rails
127 Roller track units
128 Cable-operating pulleys
129 Flap actuator (hydraulic jack with quick-thread to give irreversible rotary output)
130 Flap torque-tube driving 131
131 Flap-actuating cable drums
132 Port flap sections illustrated in fully-up position

Powerplants

133 Rolls-Royce Tyne 1 turboprops installed as completely equipped engine-change units

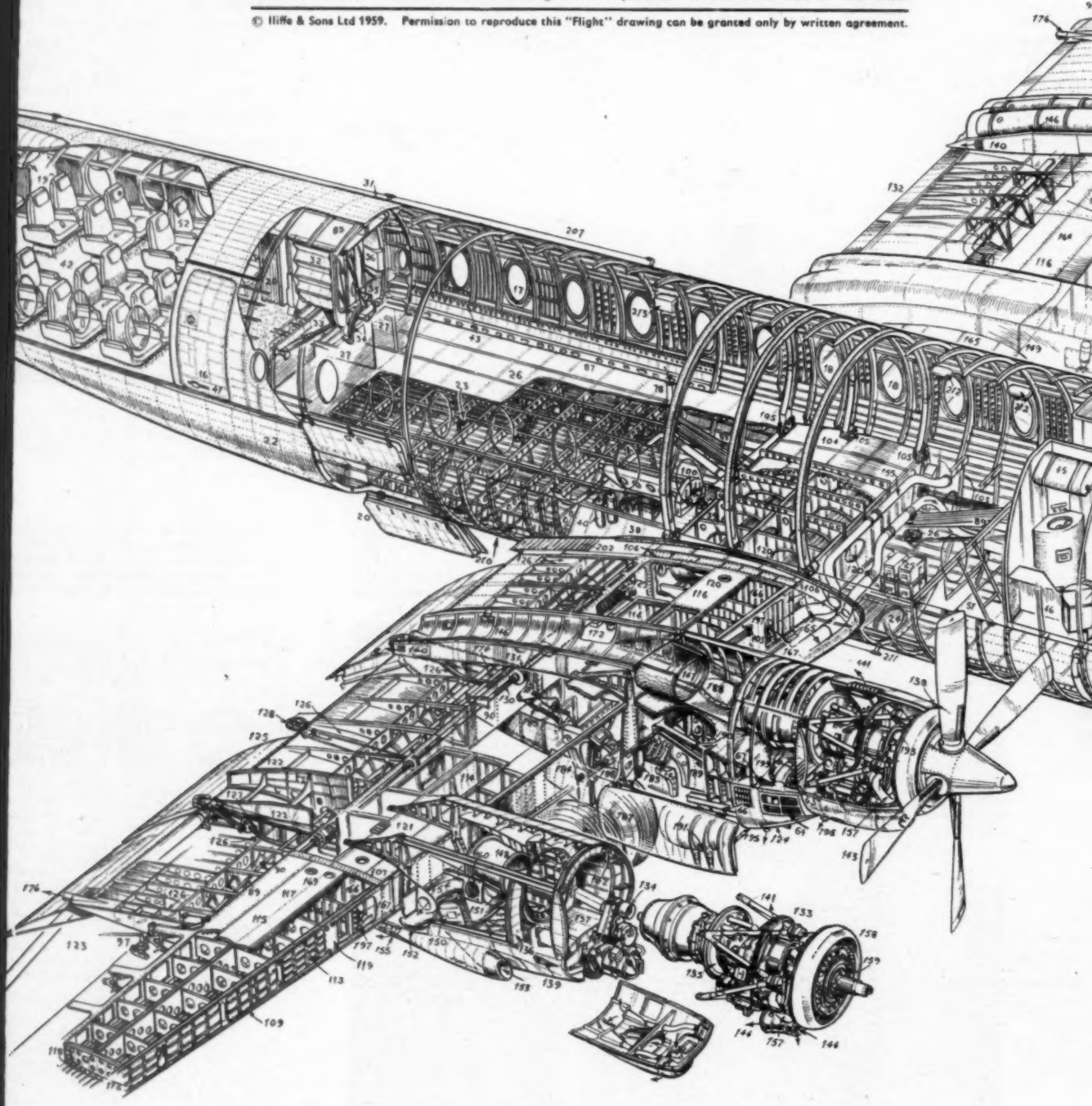


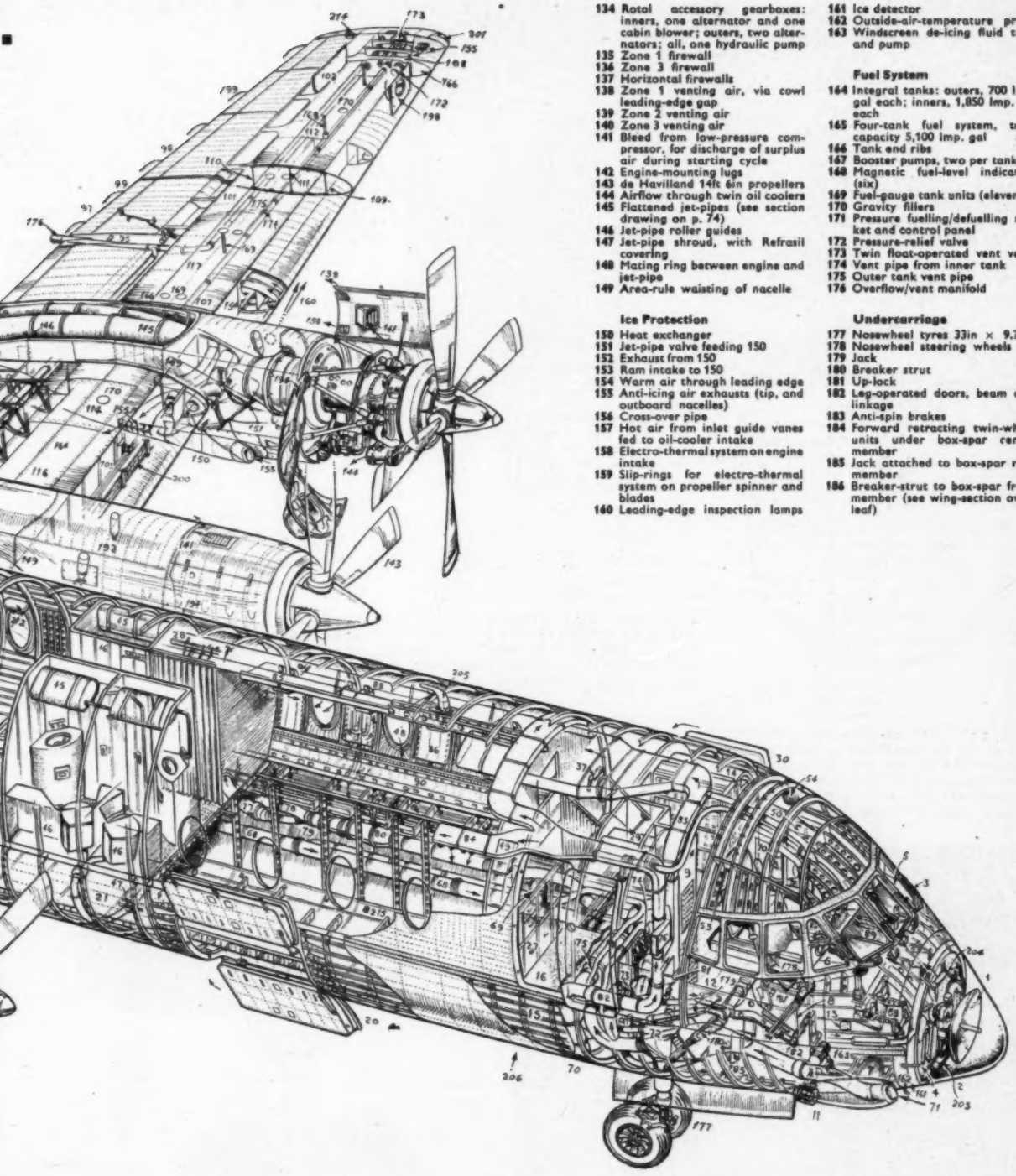
VICKERS VANGUARD . . .

Four 4,985/5,525 h.p. Rolls-Royce Tyne turboprops

This detailed cut-away drawing is the joint work of three of our artists whose contributions (fuselage, wings and engines, and rear end with empennage) incorporate an unprecedented amount of detail. The machine depicted is the present V.951, which was finished on December 4. No attempt has been made to illustrate an airline interior; instead, the maximum emphasis has been placed on clarifying the basic "hardware" of the aircraft. Additional diagrams are provided on the other side of this sheet

© Iliffe & Sons Ltd 1959. Permission to reproduce this "Flight" drawing can be granted only by written agreement.





134 Rotol accessory gearboxes: inners, one alternator and one cabin blower; outers, two alternators; all, one hydraulic pump
135 Zone 1 firewall
136 Zone 3 firewall
137 Horizontal firewalls
138 Zone 1 venting air, via cowl leading-edge gap
139 Zone 2 venting air
140 Zone 3 venting air
141 Bleed from low-pressure compressor, for discharge of surplus air during starting cycle
142 Engine-mounting lugs
143 de Havilland 14ft 6in propellers
144 Airflow through twin oil coolers
145 Flattened jet-pipes (see section drawing on p. 74)
146 Jet-pipe roller guides
147 Jet-pipe shroud, with Refrasil covering
148 Mating ring between engine and jet-pipe
149 Area-rule waisting of nacelle

Ice Protection

150 Heat exchanger
151 Jet-pipe valve feeding 150
152 Exhaust from 150
153 Ram intake to 150
154 Warm air through leading edge
155 Anti-icing air exhausts (tip, and outboard nacelles)
156 Cross-over pipe
157 Hot air from inlet guide vanes fed to oil-cooler intake
158 Electro-thermal system on engine intake
159 Slip-rings for electro-thermal system on propeller spinner and blades
160 Leading-edge inspection lamps
161 Ice detector
162 Outside-air-temperature probe
163 Windscreen de-icing fluid tank and pump

Fuel System

164 Integral tanks: outers, 700 Imp. gal each; inners, 1,850 Imp. gal each
165 Four-tank fuel system, total capacity 5,100 Imp. gal
166 Tank end ribs
167 Booster pumps, two per tank
168 Magnetic fuel-level indicators (six)
169 Fuel-gauge tank units (eleven)
170 Gravity fillers
171 Pressure fuelling/defuelling socket and control panel
172 Pressure-relief valve
173 Twin float-operated vent valve
174 Vent pipe from inner tank
175 Outer tank vent pipe
176 Overflow/vent manifold

Undercarriage

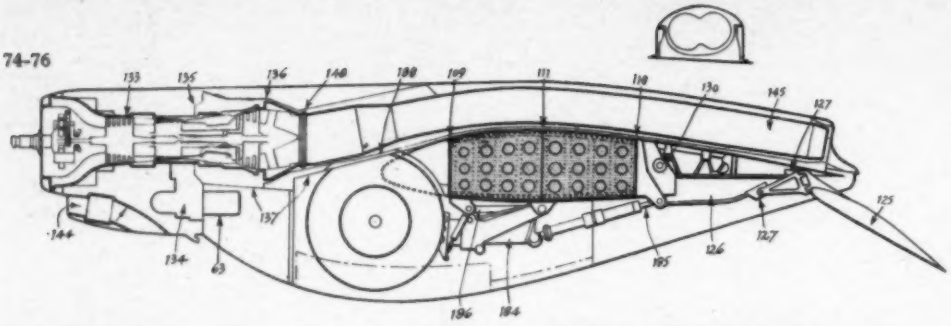
177 Nosewheel tyres 33in × 9.75in
178 Nosewheel steering wheels
179 Jack
180 Breaker strut
181 Up-lock
182 Leg-operated doors, beam and linkage
183 Anti-spin brakes
184 Forward retracting twin-wheel units under box-spar centre member
185 Jack attached to box-spar rear member
186 Breaker-strut to box-spar front member (see wing-section overleaf)

187 Dunlop tyres 50in, wheels, brakes, Maxaret (Goodyear in T.C.A. aircraft)
188 Blisters in top of wheel-well
189 Leg-well doors linked to wheel-well doors
190 Moving leg operates doors via beam and linkage
191 Door inner skin relieved for wheel

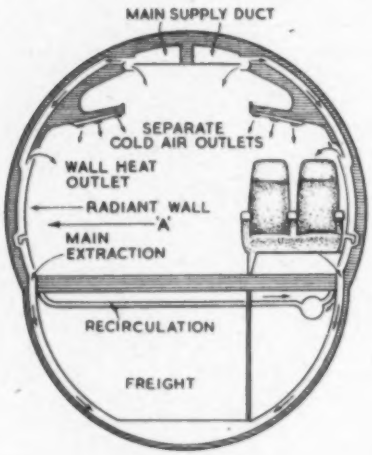
Miscellaneous

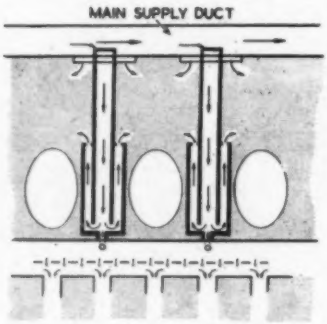
192 Two fire suppression bottles each nacelle (two-shot system)
193 Spray-rings, Zones 1 and 2 (Firewire system)
194 Fire access panels
195 Centralized drains, tank and outlet
196 Cowling drains
197 Fuel-tank water drains
198 Landing lamp under each wing tip (access panel open)
199 Static dischargers
200 Glass-fibre cable ducts throughout
201 Flashing navigation lights
202 H.F. slot
203 Glide slope
204 V.H.F. stand-by
205 V.H.F
206 Radio altimeter (on centre-line)
207 H.F. wire
208 I.L.S. localizer
209 Fin tip I.L.S./V.O.R. localizer
210 V.H.F. No. 2 (port side)
211 A.D.F. sense
212 Suppressed A.D.F. loops
213 H.F. tuning unit
214 Flux detector
215 Freight lashing points

74-76



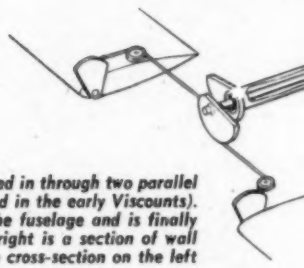
Despite its power of over 5,000 h.p., the Rolls-Royce Tyne turboprop occupies a relatively minor proportion of the nacelle. This diagram depicts a typical Vanguard inboard nacelle, the configuration of which is largely dictated by the necessity of accommodating the retracted twin-wheel main undercarriage units with low-pressure tyres. The wing structure, integral fuel tankage (shaded), flap geometry and jet-pipe section (inset) can be clearly seen. The numbers correspond with those on the main drawing on the other side of this sheet



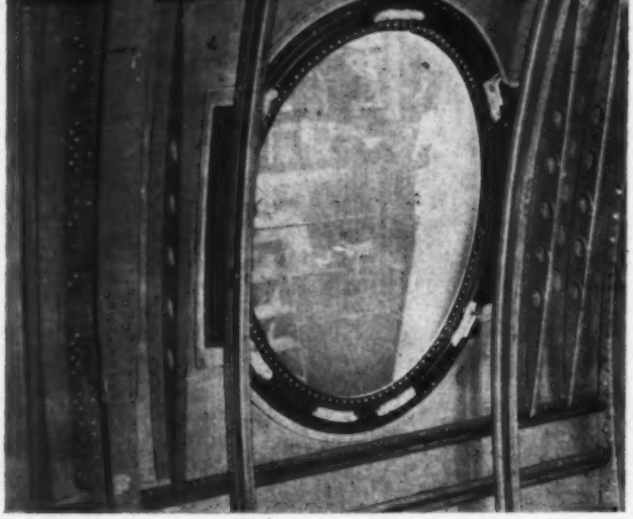


As described in the text, the main cabin-air supply is fed in through two parallel ducts in the roof (the converse of the practice followed in the early Viscounts). From this duct the air is passed down the sides of the fuselage and is finally exhausted into the underfloor freight holds. On the right is a section of wall ducting looking in the direction of the arrow A in the cross-section on the left

Above, a detail of the extremely neat the elevators and rudder; owing to th Vanguard, honeycomb-stabilized skin riveted to a light interior skeleton. sketch of the anti-upfloat linkage b which ensures that upfloat cannot oc tion of the surfaces under high-lift stall, for example)



Below, a close-up of one of the 19in × 26in (1:√2) windows. Points worth noting are: window size is sufficient to act as an emergency exit without a rectangular surround; the aperture is bounded by a top-hat frame; stringers and frames are continuous; all structural members are cleated to the skin so that not more than 100 sq in (20in × 5in) of skin is unsupported anywhere; and vertical frame-lets are stationed between the windows to stop cracks and take hoop stresses



The design and manufacture of the main and nose unit the undercarriage is handled by Vickers themselves, a the case of all Vickers' recent aircraft. This photog shows the starboard main gear, looking aft, and emphas the cleanliness of the design and the size of the

VICKERS VANGUARD . . .

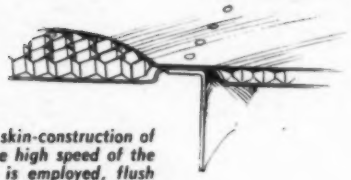
VICKERS-ARMSTRONGS VANGUARD

Four Rolls-Royce Tyne engines, with ratings varying as described in the text on an earlier page. Four-bladed de Havilland propellers.

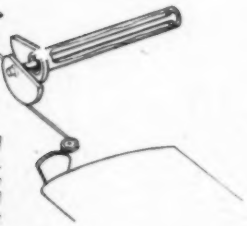
Dimensions: span, 118ft; length, 122ft 10.4in; height, 35ft; gross wing area, 1,529 sq ft; undercarriage track (between legs), 30ft 2.8in; wheelbase 40ft 6.35in; interior radius of fuselage upper "bubble", 69in; interior radius of lower bubble, 64.4in; height of centre of upper bubble above floor, 25.15in; usable length of passenger cabin, 90ft; interior volume of passenger cabin, 5,890 cu ft; volume of freight hold, 1,360 cu ft.

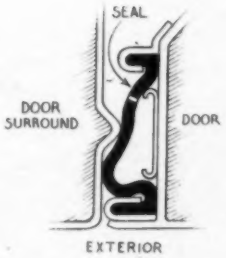
Weights: approximate normal empty weight, 78,500 lb; basic operating weight, 82,000 to 84,000 lb; design zero-fuel weight, 112,500 lb (98,500 lb in V.951, the first six B.E.A. aircraft); maximum landing, 121,000 lb (103,500 lb in V.951) maximum weight, 141,000 lb (135,000 lb in V.951); maximum payload, 29,000 lb (21,000 lb in V.951 and 24,000 in T.C.A. V.952); further details are given in the payload/range diagram on p. 67.

Performance: curves of most basic performance parameters are given on p. 67; the following are some specific estimated figures: maximum cruising speed at typical weight, 420 m.p.h. at 20,000ft (393 m.p.h. at 18,000ft for V.951 and at least 440 m.p.h. with developed engines); field length required, 6,180ft at max. weight (V.953), I.S.A., sea level; gross fuel consumption, approximately 710 Imp. gal/hr; range with full reserves with max. payload (29,000 lb, V.953), 2,000 statute miles.

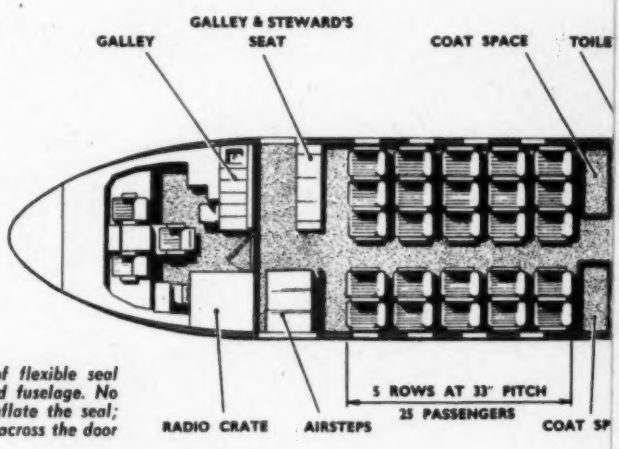


xtremely neat skin-construction of r; owing to the high speed of the tabilized skin is employed, flush ior skeleton. Below, a schematic oat linkage between the ailerons, oat cannot occur owing to deflec- der high-lift conditions (near the , for example)

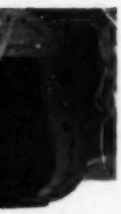




Above, a detail of the entirely new design of flexible seal employed around main doors in the pressurized fuselage. No separate pressurizing system is employed to inflate the seal; instead it is seated by the pressure differential across the door

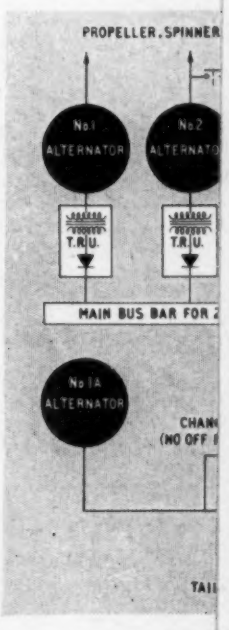


and nose units of themselves, as in This photograph t, and emphasizes size of the tyres



Probably the most outstanding feature of the entire design is the volume of the under-floor freight holds. Capacities of the forward and aft holds are respectively 750 cu ft and 610 cu ft, and this photograph was taken inside the forward hold, looking aft; on the left is the loading door and on the right can be seen the readily accessible service bay, occupied mainly by the air-conditioning ducting. The door width of 66in is great enough for loading and unloading to proceed simultaneously

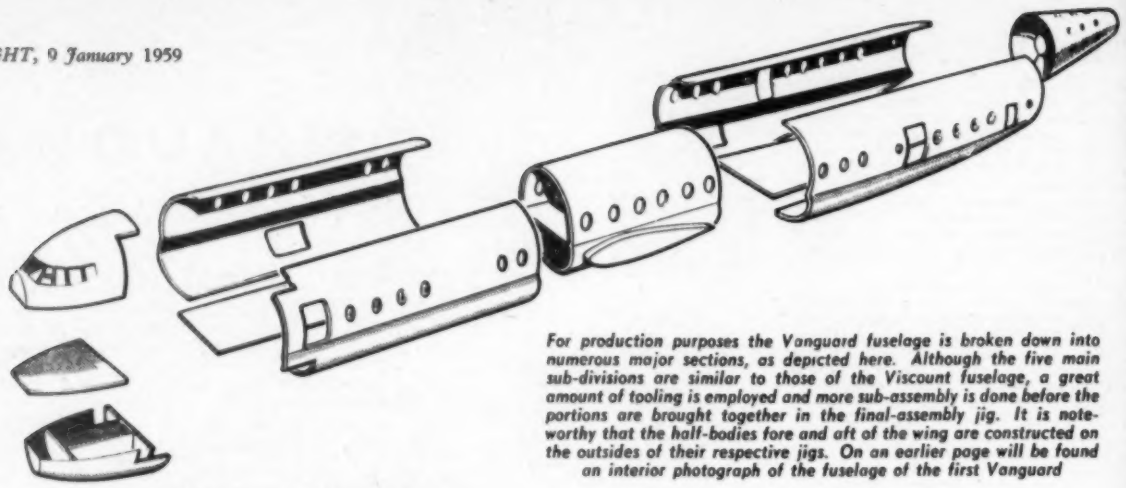
Above is a typical mixed-cl two-class transport, the tw Each class of passenger is p Seats can be mounted to fac for up to 139 passengers.



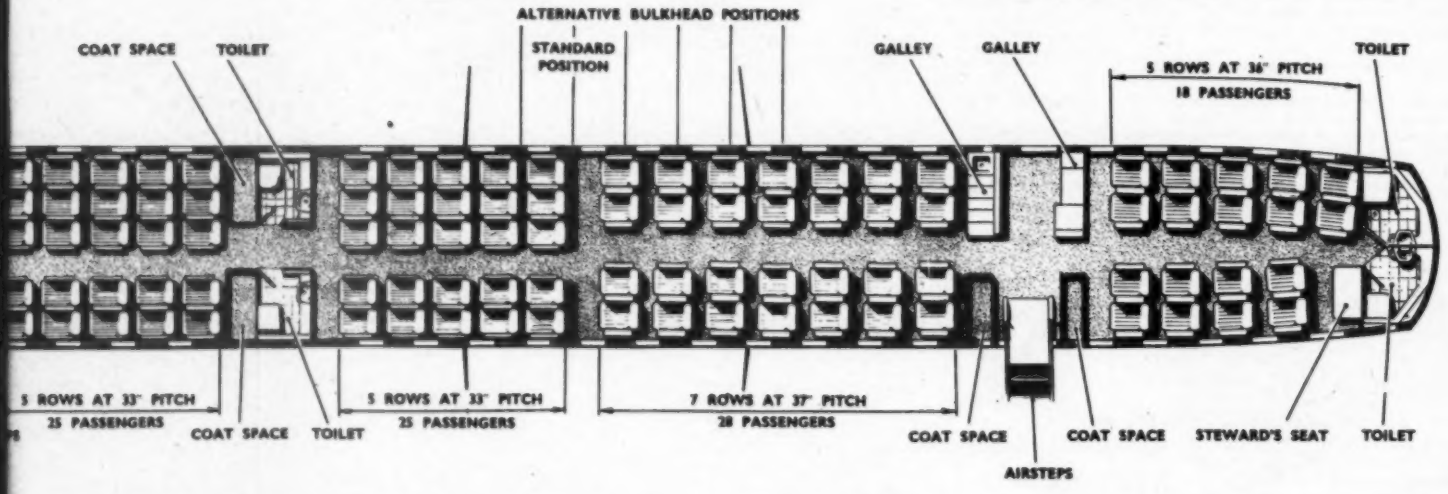
lavilland propellers.
30ft 2.8in; wheelbase
e above floor, 25.15in;

12,500 lb (98,500 lb in
in V.951); maximum

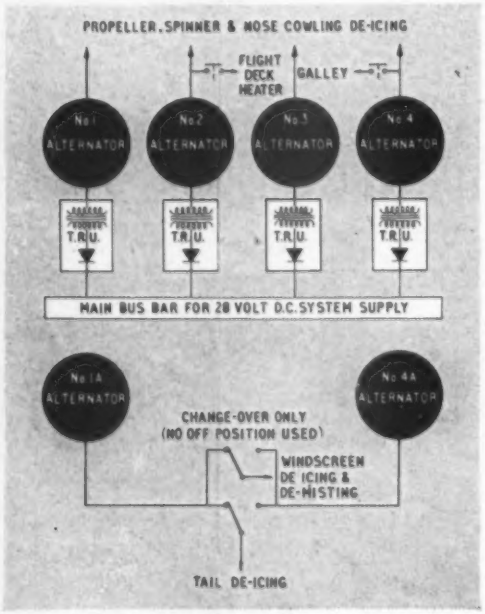
s: maximum cruising
field length required,
es with max. payload



For production purposes the Vanguard fuselage is broken down into numerous major sections, as depicted here. Although the five main sub-divisions are similar to those of the Viscount fuselage, a great amount of tooling is employed and more sub-assembly is done before the portions are brought together in the final-assembly jig. It is noteworthy that the half-bodies fore and aft of the wing are constructed on the outsides of their respective jigs. On an earlier page will be found an interior photograph of the fuselage of the first Vanguard

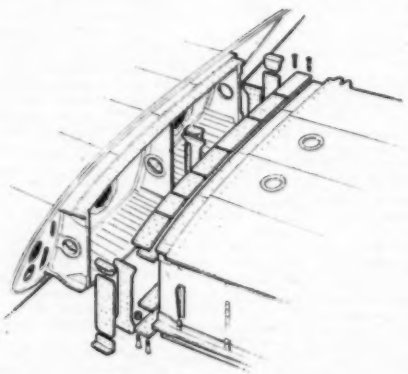


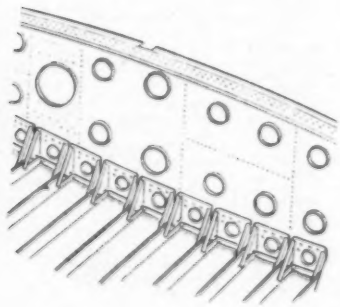
Above is a typical mixed-class configuration for the Vanguard, in which three cabins are equipped for a total of 96 passengers. The Vanguard has been designed basically as a two-class transport, the two sections being divided by a splitter bulkhead which can be attached (by means of quick-releases to the seat rails and roof) in any of six positions. Each class of passenger is provided with a separate system of entry doors, toilets and pantries, the toilets for the forward class being mounted in the plane of the propeller discs. Seats can be mounted to face either fore or aft, each seat-unit being located on a side rail and a single floor rail; 4-, 5- and 6-abreast seating can be used to provide accommodation for up to 139 passengers. The flight deck is exceptionally spacious and is arranged for two-crew operation, although there are provisions for a maximum flight crew of four



As outlined in the text, the Vanguard has a 28 V D.C. electrical system energized by alternators feeding through transformer/rectifier units. The latter appear as T.R.U.s in the basic system-diagram on the left

On the right is a detail of the joint between the port inner wing and centre section. Major loads are transmitted by a multiplicity of small butt-strap sections secured by four rows of fitted bolts. Each of the three shear-webs is joined to its neighbour by a pair of cleats





Left, a detail of a major joint between one of the machined wing skins and a transverse rib. Between each pair of machined stringers is housed a cleat, some of which are forged, through riveted to the skin and rib. The particular rib chosen is one of the light sheet ribs, pierced with flanged holes; ribs carrying heavy loads are machined from slabs

AIR COMMERCE

LONDON-PARIS CARAVELLES

IN an unexpected announcement last week Air France said that bookings for Caravelle flights between London and Paris can be accepted from July 1. Hitherto the French airline has not included London - Paris in its early Caravelle plans—surprisingly, perhaps, since this B.E.A.-Air France route is highly competitive, there being no revenue-pool agreement with B.E.A., whose Viscount business would obviously be threatened by Caravelle "quality competition."

The reason for Air France's change of mind is not clear. Just one daily service, tourist and first-class, will be operated initially. As already reported, a daily Caravelle service between London and Nice will begin in mid-June.

AER LINGUS FRIENDSHIP IN LONDON

NEXT Tuesday, January 13, Aer Lingus are due to demonstrate the Friendship at London Airport. Here are some impressions of the aircraft from a correspondent in Ireland:—

"The aircraft has nine large yellow-tinted oval windows on each side. Seating, by Rumbold, is for 40 in 18 forward-facing double seats and two rearward-facing double seats next to the forward cabin bulkhead, at a pitch of 35½in. The cabin interior, by James Gardner, is cheerfully decorated in the contemporary style in pale-grey and pale-green plastic, with mustard-coloured curtains. The seats are pale-grey and the black carpet has an emerald pattern.

"Forward of the cabin, the buffet is on the port side and the baggage-hold is opposite. The flight-deck bulkhead contains the Collins Radio V.H.F., H.F., V.O.R., intercom and R.I.C., and the neat jump-seat forms a step up to the flight-deck when folded. The spacious flight-deck is arranged for two pilots and the flight instrument panels have the contemporary grey background."

Aer Lingus introduced the Fokker Friendship into regular service on December 15, when services between Dublin and Glasgow and Dublin and Liverpool began. The airline introduced Friendships on to the Dublin - Paris route on December 17.

Other Friendship news is that the first for Braathens, LN-SUN, was delivered to Oslo on December 22, having been handed over two days previously. This aircraft will operate between Oslo and points in western Norway. Fokker also have referred to Friendship fatigue-testing (*Flight*, December 12, 1958). Our report stated that T.A.A., like Aer Lingus and Braathens, would return their aircraft to the makers for modifications before the completion of 5,000 hours' service. In fact, T.A.A.'s aircraft will be delivered fully modified. Some revision of delivery date has inevitably been entailed; as at present planned the first aircraft will be handed over on March 31, only one month behind contractual delivery date. We hope to give the background to the T.A.A.-Fokker discussions in a later issue.

REFEREE WANTED?

THE Jack Inquiry's report into the B.O.A.C. strike rebuked two people, Mr. C. Jenkins of A.S.S.E.T. (Association of Supervisory Staffs Executives and Technicians) and Mr. Ian Mikardo, M.P. The report described some of the evidence as "mischievous."

Now A.S.S.E.T. has replied by publishing in booklet form the full Jenkins and Mikardo evidence, and accusing the Court of Inquiry of "bias." The Association challenges, in effect, the justness of the word "mischievous."

A careful re-reading of the full evidence of the two men might well give most fair-minded people doubts that the Court's choice of the strong word "mischievous" was a just one. A better choice, perhaps, might have been "doctrinaire." The leaders of A.S.S.E.T., perhaps more than those of other London Airport unions, appear to be obsessed with the charge that Britain's private-enterprise independent operators are stealing away the Corporation's traffic. The front cover of the booklet is illustrated with a table showing independent scheduled traffic-growth *versus* that of the Corporations. And on the inside back cover prominence is given to B.E.A.'s unprecedentedly testy remark that "independent airline traffic-growth statistics do not suggest that they [the independents] have much to complain about."

Unfortunately, it is difficult to prove that the independents' traffic-growth has in fact been at the expense of the Corporations. There may be union and Corporation allegations to this effect—but no proof is ever offered. And percentages are notoriously misleading. That there was an increase of independent l.t.ms of 212 per cent from 1954-57, compared with 40 per cent for the Corporations, is correct; but a 20:1 difference in the base-line is ignored. It could with equal justification be said that in terms of *absolute* traffic growth, the two Corporations' traffic went up by 74 million load ton-miles, while independent traffic increased by only 17 million load ton-miles. Nor is it ever acknowledged that the independents' scheduled traffic produces revenue-rates which are only a half to two-thirds those of the Corporations.

It is becoming increasingly unrealistic to measure the progress of British air transport in narrow terms of private-enterprise *v.* public ownership. Business as a whole is growing, more people are flying who have not flown before, and an expanding industry means expanding employment. The industry may well be ready for an executive referee to take the field.

Vickers' chief test pilot, Jack Bryce, seen here in the Vanguard, is expected in a few days' time to make the maiden flight from Weybridge. A particularly impressive photograph of the spacious Vanguard flight-deck appears on page 68

THE ONE LEAN YEAR

TRAFFIC carried by U.S. airlines amounts to about two-thirds of the world total. This fact alone ensures that the American rate of growth follows closely along the global path plotted by I.C.A.O. The Organization's figures for last year showed an increase of 5 per cent in total load; passengers, freight and mail increased by 5, 1 and 7 per cent respectively. By comparison the U.S. carriers together experienced an estimated increase in total load of 2 per cent.

The major element in the U.S. industry—the domestic trunk carriers—increased their total traffic by only 1.5 per cent. The international carriers and the local-service airlines increased their traffic by 6 and 7 per cent respectively but the greatest improvements were experienced by the helicopter operators (traffic up by about one third) and by carriers in Hawaii and Puerto Rico (up by one quarter). The all-freight carriers and the Alaskan airlines, on the other hand, suffered respective falls of 11 and 10 per cent.

Here is an impression of the Sud-Aviation SE.3200, a triple-turbine, 28-seat helicopter aimed at both civil and military markets. Republic Aviation, who have already taken out a licence to build the Sud-Aviation Alouette, have expressed their interest in this new development

Ghana Airways took delivery of the first of their two Herons at Hatfield on December 30. Left to right, Mr. T. Ephson (Ghana High Commission), Mr. Peter de Havilland, Mr. J. Jantuah (Deputy High Commissioner for Ghana), Mr. G. M. Johnson (B.O.A.C.), Mr. A. G. Edwards (D.H.) and Mr. J. B. Odunton (Ghana High Commission)

AIR COMMERCE . . .

A GALLUP OF STATISTICIANS

SOME airlines are not afraid of having their activities exposed to the public eye, others prefer obscurity. Unfortunately, at the recently concluded conference held by I.C.A.O.'s statistics division, the latter group appeared to have won the day.

The main subject under discussion was whether member-nations should be obliged to provide data showing the origin and destination of their airlines' passenger traffic. The American Government was anxious to see this information made available, and argued that sensible bilateral agreements could hardly be drawn up in ignorance of the relevant facts. But less confident countries feared that the Americans would use such information as a big stick during bilateral negotiations, while others felt that the job of collecting reliable statistics would be unbearably difficult. The opposition of the French Government to collection of O and D statistics was particularly strong. In an effort to compromise, the meeting agreed to pass on the subject to "a panel of statistical experts."

Other subjects discussed at the conference included the preparation of standardized and comprehensive airport statistics, the presentation of statements classifying the number of civil aircraft registered in each country, and the analysis of airline mail traffic.

REPUBLIC-SUD CO-OPERATION

PROGRESS is being made towards closer collaboration between Republic Aviation Corporation and Sud-Aviation on the products manufactured and distributed by the two companies. Republic already has an agreement with Sud for the assembly and marketing of the Alouette and has recently been demonstrating the Djinn to U.S. military and civil interests. It is stated that when the new agreement is finalized it will presumably include these two helicopters and larger ones now being tested by Sud, while the Caravelle would receive Republic's full support as sales are developed to U.S. airline companies.

ECONOMY-CLASS HELICOPTER

CUBANA are about to complete construction of their first helicopter. The airline has courageously launched forth on the manufacture of six aircraft which, it is hoped, will be used for services between Havana airport and the downtown heliport. A number of local hotels are also said to be contemplating the construction of heliports.

The Cubana helicopter, designated C-58, was designed by Sr. Juan de la Cierva of Hoces, a nephew of the inventor of the Autogiro. Equipped as a four-seater, the C-58 has a take-off weight of 3,000 lb (empty weight 1,978 lb) and is powered by a 260 h.p. engine.

But the manufacturers believe that the main attraction of their product will be its price. Compared with equivalent American helicopters costing about $89,000 (£31,760) apiece, the C-58 is intended to sell for a mere $10,000 (£3,570).

As from the beginning of this year the aviation section of British Petroleum has adopted the trading title of Air BP. Their new insignia is evident on this refuelling unit and comprises the familiar green and yellow BP shield flanked by a single red wing

LONDON HELICOPTER PLANS

THE Battersea heliport is now nearing completion and should be in use by the spring. Work on this Westland project started last August and, although the original "delivery date" of December was not attained, no time has been lost in constructing London's only helicopter station.

The York Road site is expected initially to provide a base primarily for charter flights, the only regular operators at present in prospect being B.E.A. and Rotorports. But whereas the Corporation has shown more interest in an inter-airport service linking L.A.P., Gatwick and Southend, Rotorports are hoping to receive permission from the M.T.C.A. to operate between London town centre and Southend, Manston, Rochester and L.A.P. As the London County Council are not in favour of permitting the construction of a heliport at Nine Elms (the other Rotorport's proposal, for a pontoon site off the Albert Embankment, was turned down last June), the situation of their London base remains uncertain. Rotorports do not at present own any aircraft, but an associate company, Film Aviation Services, possess a Bell 47.

LOWER PROFITS FOR S.A.S

S.A.S. have issued provisional financial results for the fiscal year ended September 30, 1958. The format of their accounts makes it almost impossible to establish a precise annual profit figure but the latest results appear to follow the typical current pattern: increased revenue, decreased profit.

Traffic revenue increased by 9 per cent to Sw. Crs. 502m (£35m), while total revenue from all sources reached Sw. Crs. 546m (£38m). But costs, excluding depreciation, rose even more sharply. Consequently, the amount available for depreciation and for dividend was sharply reduced. In brief, then, average revenue rates fell while unit costs rose. Load factor was substantially unchanged at the remarkably low level of 51 per cent.

ARE EXECUTIVES BEING EXECUTED?

PANAM have recently published information on their staff health programmes. Analysis of 60 examinations carried out among their executives last spring revealed that 50 per cent suffered from "significant defects." The comparable figure for pilots was only 13 per cent.

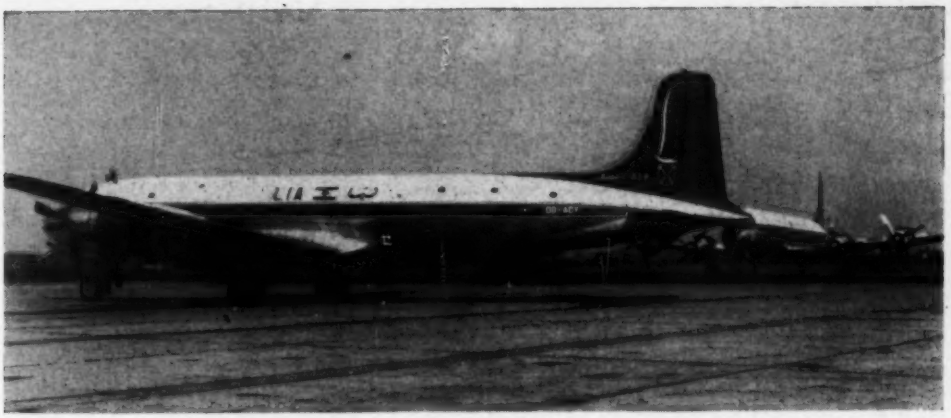
In a paper presented to the British Medical Association, the medical director of the airline's Atlantic division, Dr. Otis B. Schreuder, viewed these figures against the general background of industrial medicine. Previous studies had shown that although an investment in health was good business, the fact remained "that health problems of management employees were often overlooked." American experience has suggested that "there is a consistent profit of $3.50 to $5 for each dollar spent in the medical department."

Dr. Schreuder discussed the medical principles adopted by his company and described the routine adopted for preplacement and periodic physical examinations. He emphasized particularly the need to keep a close watch over the effect of mental stress and strain among executive staff.

JET DEBT

THREE more domestic trunk carriers in the U.S. have completed their arrangements to finance jet equipment. National, Delta and Eastern had to find $48m, $29m and $23m respectively, and by the year end each of these carriers had secured the necessary credit.

National reduced their capital needs by cutting their DC-8 order from six to three and by relying on an aircraft exchange



A Lebanese International Airways DC-6B prepares to depart from Brussels on the twice-weekly service to Beirut via Paris and Milan

arrangement with PanAm. Long-term loans valued at $40m were then negotiated with two banks (Chemical Corn Exchange and First National City) to cover purchase of the three DC-8s and 12 of the 23 Electras on order.

Delta have also reduced their needs by a reduction in their DC-8 order (from eight to six) and have covered their outstanding commitments by obtaining $60m bank loans. This includes $35m short-term credit, most of which will be utilized to refund existing bank debts. The $25m long-term credit bears interest at 6 per cent.

Eastern have managed to secure credits worth $75m of which $25m is debenture stock issued to the Prudential.

LEBANESE INDEPENDENT

THE two old-established Lebanese airlines are both closely identified with foreign carriers: Air Liban with Air France, Middle East Airlines with B.O.A.C. But the latest company to inaugurate regular air services from Beirut, Lebanese International Airways, is entirely financed from local sources, and thus claims to be the country's national carrier.

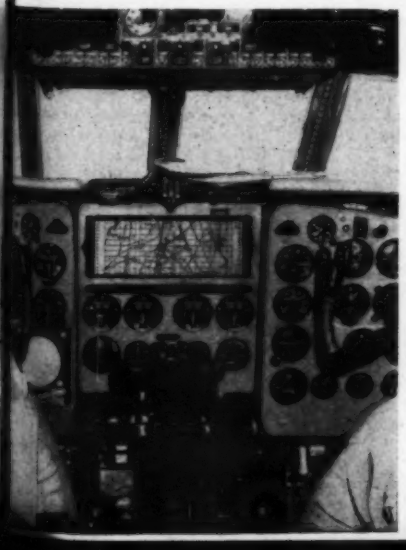
L.I.A.'s predecessor, Lebanese Airways, operated charter services with two C-46s, but one of these crashed with considerable loss of life in October 1957. The company was subsequently reorganized and last year acquired a DC-6B from Sabena. L.I.A. also operate two DC-4s on charter from Sabena. A C-46, inherited from Lebanese Airways, is not in use and awaits disposal.

The DC-6B makes two flights a week from Brussels to Beirut *via* Paris and Milan, and two from Beirut to Teheran. The weekly DC-4 programme includes five flights from Beirut to Kuwait, two to Bahrain and Baghdad, and one to Doha.

Sabena provide technical assistance, all major maintenance being carried out at Melsbroek. Pilots, radio officers and cabin crew are Lebanese under training from Sabena staff. Mr. A. J. Pieraerts has been seconded from the Sabena organization to manage L.I.A.'s affairs in Belgium.

Lebanese International charge I.A.T.A. fares on all routes but have no intention of becoming members of the Association. One reason for this is that the Lebanon has some 90 travel agencies, 21 of whom are I.A.T.A. appointed; the new line wishes to sell seats through all 90. Another reason given is the high cost of attending conferences. A third is the desire to compete with the score of airlines flying through Beirut, two of which (Air Liban and M.E.A.) are Lebanese. Competition takes the form of increased comfort and extra meals without restriction. The first-class compartment, for example, has only 12 seats, with leg-rests of the de luxe type, whereas I.A.T.A. regulations would require the installation of 16 seats in an equivalent space.

The president of L.I.A. is Mr. A. Arida. Capt. J. van Rooyen and Mr. A. Eid are, respectively, general manager and commercial manager.



Following an 18-month evaluation by the Ministry of Supply, B.O.A.C. have decided to equip their North Atlantic Comet 4 fleet with Decca/Dectra. The presentation is clearly evident in this cockpit view of the Ministry's Comet 2E

COMET 4s FOR MISRAIR?

SINCE last September, when de Havilland demonstrated the Comet 4 to Misrair in Cairo (*en route* for Hong Kong on a pre-service proving flight), there have been persistent reports that the Egyptians were seriously interested in the aircraft. In the *Daily Express* of November 27 it was reported that Misrair had sent a delegation to Hatfield to discuss the purchase of one or two Comet 4s. This report could not be confirmed by de Havilland. Again, last week, the *Daily Herald* reported that Egypt was ready to place a £3 million order for Comet 4s (a sum which suggests an order for two aircraft plus spares) and that the deal depended on the general financial negotiations which began in Cairo on January 1 between Egypt and the president of the World Bank, Mr. Eugene Black. Upon these talks depends the possibility that Britain might release Egypt's blocked sterling. This amounts, it is reported, to £80 million. Presumably the purchase of Comets depends in turn upon the success of these talks.

It is encouraging that Misrair's technical choice appears to be the Comet regardless of the political differences between the two countries. Misrair are typical of a number of small-to-medium-sized airlines which want to buy jets, but which cannot justify the size or expense of the 707 and DC-8. Airlines besides Misrair whose interest in the Comet has been reported include Air Ceylon, Middle East Airlines, L.O.T., L.A.V., C.P.A.L. and Eagle. Whether or not the interest of these carriers materializes into firm orders remains to be seen; but the interest itself gives cause for increasing optimism about the sales prospects of Comet 4, of which another 30 or 40 have to be sold to break even.

CROSS-CHANNEL "FACILITATION"

A SMALL victory for the airlines' campaign against international red tape, a campaign which is officially entitled "facilitation," was announced at the turn of the year. The British and French governments agreed to allow day excursions by air without passports between certain specified points for an experimental period. There have already been similar passport relaxations on cross-Channel sea excursions, but this is the first time that our airlines will benefit from no-passport travel on their services to France.

Two British operators will benefit first: Silver City were quick to announce no-passport day excursions between Lydd (Kent) and Le Touquet, starting on March 26 and operating until September 30. The airline justifiably emphasizes the appeal of such a day-trip to the Continent, which will cost only 65s for the return journey.

Air Charter, who operate the Channel Air Bridge service, announced no-passport day trips between Southend and Calais, starting at the end of this month. This day-trip is offered for 70s, and a large number of services a day might be operated depending on demand.

The agreement between Britain and France specifies that no-passport passengers shall be British subjects or citizens of the Irish Republic. An identity card will be issued instead of a passport. Other routes on which the no-passport facility is available are London Airport - Paris; Southend - Le Touquet; Lympne - Beauvais; Lydd - Calais.

AIR COMMERCE . . .

The first of six de Havilland Comet 4Bs ordered by B.E.A. is seen here taking shape at Hatfield. The two B.E.A. captains in the picture (with 12 other B.E.A. staff they are on a seven-week D.H. and Rolls-Royce training course) are Capt. W. Baillie (left), general flight manager, and Capt. G. T. Greenhalgh, who will be flight manager of the B.E.A. Comet Flight. Plans call for 30 B.E.A. Comet 4B crews, each of which will comprise three pilots

B.E.A. ROTODYNES?

PURCHASE of "a developed version" of the Fairey Rotodyne is being seriously considered by B.E.A. In a letter of intent to the manufacturers, Lord Douglas of Kirtleside, the chairman, has explained that the Corporation is not in a position at present to place a firm order, but that six aircraft would be ordered if Government financial approval were given, and if the developed version matched B.E.A.'s requirements.

The Government has supported much of the Rotodyne programme to date and has been reluctant to embark further without the prospect of a successful civil market. In the light of B.E.A.'s latest move that prospect is certainly now improved.

It is likely that the modifications sought by the Corporation will result in a larger, faster vehicle powered by Rolls-Royce Tynes. A note on the Rotodyne's recent remarkable record appears on page 52.

SHIPPING FORSAKEN

NORTH ATLANTIC traffic statistics provided the brightest aspect of last year's gloomy airline record. In a year when total traffic increased by only 5 per cent, the number of passengers crossing the North Atlantic rose by about a quarter to reach a record figure of some 1¼ million.

That this increase is not entirely the result of creating a new class of traffic is shown by the Conference figures for shipping traffic last year; the number of people travelling by sea between North America and Europe fell by 7 per cent. Traffic carried on Conference lines rose steadily in the first post-war decade, passing the million mark in 1956 and reaching a peak figure of 1,036,923 in 1957. Last year the figure dropped back to 959,325 passengers, equivalent to the 1955 level. This fall was due to a deterioration of traffic on Canada - Europe services of as much as 95,000 (the 1957 level was inflated by an unusual volume of emigrant business). Traffic between the U.S. and Europe increased slightly—by 17,400 passengers.

Cunard continued to hold a position among the shipping companies analogous to that of PanAm among the airlines—each carried about one quarter of total respective sea and air traffic. But whereas PanAm's share fell slightly, Cunard steamed ahead at the expense of their rivals.

BREVITIES

The first of Pakistan International Airlines' three Viscount 810s was handed over at Vickers' airfield at Wisley on January 2. The aircraft was accepted by Mr. M. Ikramullah, Pakistan High Commissioner. At the same time it was announced that P.I.A. have increased their 810 order from three to five, completion of the fifth aircraft being scheduled for October 1959. This brings total Viscount orders to 404. P.I.A.'s Viscount route network will include Karachi - Lahore - Delhi, Karachi - Bombay and Middle Eastern routes.

* * *

A DC-3 recently transferred from Skyways to Samlesbury Engineering has now been delivered to Bahamas Airways.

* * *

Aircraft Exchange Inc., the new airliner sales organization, announces that Mr. Denis Handover has been appointed U.K. and European representative in London. Mr. Handover is a former traffic director of B.O.A.C., his experience in air transport extending over 38 years.

* * *

A report in the Italian journal *Settimana Alata* that Lufthansa intend to change their order for Boeing 707s to an order for Douglas DC-8s so as to standardize with Alitalia was last week described by a London spokesman for Lufthansa as "completely without foundation."

* * *

"Air Transport—Chaos or Progress Ahead?" will be the title of a lecture by Mr. M. H. Curtis, M.Inst.T., Hunting-Clan's managing director, to be given to the Tees-side Institute of Transport at the Cleveland Scientific and Technical Institution at Middlesbrough on January 16 at 6.30 p.m.

* * *

Yeadon Airport will not be closed by the Leeds-Bradford Joint Aerodrome Committee, as was threatened when the airport was to be derequisitioned by the Ministry on December 31. Derequisitioning will be postponed pending agreement between the committee and Yeadon Aviation about the terms on which operations will continue.

* * *

The ExIm Bank has approved a $1 million credit to assist the sale by Douglas to Clanair Ltd. of two DC-6As. Clanair is a subsidiary of Clan Line Steamers, joint owners with the Hunting Group of Hunting-Clan Air Transport. According to *Aviation Daily*, the ExIm Bank's credit represents 60 per cent of the total delivery price; it is repayable over five years and is said to be guaranteed by Clan Line. The aircraft are already in service.

Overseas Aviation (Channel Islands) have acquired a Canadair 4 Argonaut from B.O.A.C.

* * *

A sixth B.O.A.C. Comet 4, G-APDF, was delivered by de Havilland to the Corporation on December 31, nearly two months ahead of schedule.

* * *

Mr. A. H. Milward, B.E.A.'s chief executive, left London for Montreal on January 3 on a three-week round-the-world promotion tour. He will go from Canada to Australia and return to London via Singapore.

* * *

A Scandia operated by VASP crashed into the Bay of Rio de Janeiro on December 30, reportedly after take-off from Santos Dumont airport *en route* for Sao Paulo. There were 31 passengers and a crew of four on board; 14 people are said to have survived.

* * *

Night-stops on the Viscount Safari services to East Africa have now been eliminated. Schedules on the Central African Safari service show night-stops at Entebbe. Night-stops at Las Palmas will be retained on the West African Safari service.

* * *

Southend Airport handled 52 diversions from major British airports during foggy weather on Christmas Eve. According to the Commandant of Southend, Mr. Bernard Collins, his airport remained operational largely because of its new runway lighting system. This is the new type of G.E.C. high intensity installation.

* * *

According to the president of the Argentine Air Transport Association, Brig-Gen. Juan E. Fabri, Aerolineas Argentinas "are one of the biggest money-losers in the world." The 1958 loss, reports *Aviation Daily*, was put by the general at £1.4 million ($4 million) to which was added a £9 million commitment ($25 million) for six Comet 4s.

* * *

In a New Year statement, Sir Gerard d'Erlanger, chairman of B.O.A.C., announced plans for expansion in 1959. In the spring, subject to government [American C.A.B.] approval, Britannias would operate to Tokyo and Hong Kong on the western route via New York, San Francisco, Honolulu and Wake, joining the eastern-route service to Tokyo and Hong Kong which will be taken over in the spring by Comet 4s. This would provide the first round-the-world all-turbine air service. Towards the end of 1959 Comet 4s would take over the routes to Sydney and to Johannesburg.

Four of the senior officers who have been honoured in the New Year list. From left to right, Air Chief Marshal Sir George Mills, Commander, AAFCE (G.C.B.); Acting Air Marshal W. M. L. MacDonald, C-in-C. M.E.A.F. (K.C.B.); Air Marshal (promoted from A.V-M.) W. H. Merton, A.O.A. Bomber Command (K.C.B.); and Vice-Admiral A. N. C. Bingley, Flag Officer Aircraft Carriers (K.C.B.)

SERVICE AVIATION

NEW YEAR HONOURS, AWARDS AND PROMOTIONS

Royal Air Force

MORE than 200 members of the Royal Air Force and its associated Services, both men and women, are named as recipients of honours and awards in the New Year list published last week. Besides R.A.F. officers and N.C.O.s, those named include officers of the Royal Navy, the Army Air Corps, W.R.A.F., R.Aux.A.F. and W.R.Aux.A.F., R.A.F. Reserve of Officers, R.A.F.V.R. and Princess Mary's R.A.F. Nursing Service. The full list (in which some of the ranks given are affected by the New Year promotions) is as follows:—

Honours

ORDER OF THE BATH

Knight Grand Cross: Air Chief Marshal Sir George Holroyd Mills, K.C.B., D.F.C., A.D.C., Commander, Allied Air Forces Central Europe.

Knights Commanders: Acting Air Marshal W. M. L. MacDonald, C.B., C.B.E., D.F.C., C-in-C., Middle East Air Force; A.V-M. W. H. Merton, C.B., O.B.E., A.O.A., Bomber Command.

Companions: Acting A.V-M. G. Silyn-Roberts, C.B.E., A.F.C., M.Sc., F.R.Ae.S., Director-General of Engineering, Air Ministry; A. Cdre. R. H. E. Emson, C.B.E., A.F.C., Director of Air Armament Research and Development, Ministry of Supply; A. Cdre. W. D. J. Michie, Senior Technical Staff Officer, Transport Command; A. Cdre. M. K. D. Porter, C.B.E., on Imperial Defence College course; A. Cdre. V. H. B. Roth, C.B.E., Director of Equipment (D), Air Ministry; A. Cdre. S. C. Widdows, D.F.C., Rtd., formerly Director of Operations (Air Defence), Air Ministry; Acting A. Cdre. H. I. Edwards, V.C., D.S.O., O.B.E., D.F.C., Commandant, Central Fighter Establishment.

ORDER OF THE BRITISH EMPIRE

Knights Commanders: Air Marshal H. D. Jackman, C.B., C.B.E., A.O.C-in-C., Maintenance Command; Acting Air Marshal C. E. Chilton, C.B., C.B.E., A.O.C. Malta.

Commanders: G/C. C. B. E. Burt-Andrews; G/C. W. H. Canniford; G/C. R. K. Cassels, D.F.C., A.F.C.; G/C. W. G. Devas, D.F.C., A.F.C.; G/C. T. J. Hanlon; G/C. E. J. Morris, D.S.O., D.F.C.; G/C. J. C. Pope, M.I.Mech.E., A.F.R.Ae.S.; G/C. F. C. Richardson, Rtd.; G/C. E. V. Stokes, B.Sc.; G/C. D. E. B. Wheeler, D.F.C., Rtd.; G/C. R. D. Williams, D.F.C.

Officers: Acting G/C. A. S. Knowles, A.F.C., A.F.R.Ae.S.; W/C. A. S. Baker, D.F.C.; W/C. W. K. Bell; W/C. G. Davidson; W/C. J. Eames, D.F.C., A.A.C.C.A.; W/C. N. H. Gosden, Rtd.; W/C. A. H. Hewitt; W/C. N. E. Hext, M.B.E.; W/C. W. McRobbie, A.F.C.; W/C. E. W. Merriman, M.B.E., D.F.M.; W/C. A. J. Morgan, A.F.C., A.F.M., Rtd.; W/C. H. A. Pritchard; W/C. J. R. Pullan, A.C.A.; W/C. J. Rayson, A.F.C.; Rev. W. G. Reeves (relinquished comm. 22/10/58); W/C. J. K. Silver, B.Sc.; Acting W/C. W. L. Milburn, R.A.F.V.R. (Training Branch); S/L. K. Dear, D.F.C.; S/L. H. A. Penny; S/L. F. E. Reed, Rtd.

Members: S/L. G. L. Armstrong; S/L. J. R. Dowling, D.F.C., A.F.C.; S/L. J. G. Duncan; S/L. P. Green; S/L. E. R. G. Haines, D.F.M.; S/L. J. L. Purchase; S/L. K. Sayers; S/L. E. N. Stone; S/L. C. E. G. Tomkins, Rtd.; S/L. J. Whelan, A.F.C.; Acting S/L. F. R. E. Hayter, R.A.F.V.R. (Training Branch); Acting S/L. A. E. Luff, R.A.F.V.R. (Training Branch); Acting S/L. A. Yates; F/L. R. Andrew; F/L. R. Armstrong; Flt/O. K. E. Bagley, W.R.Aux.A.F.; F/L. M. Blackburn; F/L. E. J. Blackwood; F/L. W. D. Fleet; F/L. P. H. Gibson, B.A., R.A.F.R.O.; F/L. A. R. Goss; F/L. D. W. Greenslade, A.F.C.; F/L. C. S. Jackson; F/L. C. Jones; F/L. D. W. Kill; F/L. F. S. Lacy; F/L. W. Sparks; F/L. R. F. G. Stagg; F/L. J. C. Strickett; F/L. F. W. Thornton, R.Aux.A.F.; Flt/O. C. V. Toyne, W.R.A.F.; F/L. D. J. Whitton; F/O. T. D. B. Wilson; M/Tech. L. W. Hedges; M/Tech. J. J. Jeremiah; M/Tech. L. Metcalfe; W/O. P. S. Barnes; W/O. F. Helm; W/O. J. E. Jones; W/O. R. Simpson; W/O. B. L. E. Smith; W/O. A. M. Spence; W/O. T. W. Ward; W/O. P. E. Warner; W/O. L. J. White.

Awards

Second Bar to A.F.C.: W/C. L. G. Press, A.F.C.

Bar to A.F.C.: W/C. E. James, D.F.C., A.F.C.; S/L. R. N. Bates, A.F.C.; S/L. C. Watkinson, D.F.C., A.F.C.; F/L. C. J. Morgan, A.F.C.; F/L. S. J. Thomas, A.F.C.

A.F.C.: Acting W/C. E. F. Brown, D.F.C.; S/L. D. Andrew; S/L. E. Claxton; S/L. L. Davies; S/L. T. C. Gledhill; S/L. B. J. L. Greenland; S/L. D. J. Harper; S/L. J. F. Langer; S/L. R. E. Paul; S/L. A. K. Strudwick, D.F.C.; F/L. A. H. C. Back; F/L. G. H. Beaton; F/L. H. M. Fisher; F/L. G. F. Gill; F/L. R. Hampton; F/L. D. R. Jennings; F/L. M. B. Kemp; F/L. J. H. Kingsbury; F/L. P. J. McMonagle, D.F.M.; F/L. R. D. Shrivell; F/L. S. Sollitt; F/L. W. L. Sowter; F/L. L. Swart; Cdr. P. C. S. Chilton, R.N.

Royal Red Cross (First Class): Sq/O. A. B. Miller, A.R.R.C., Princess Mary's R.A.F. Nursing Service.

Royal Red Cross (Second Class): Sq/O. W. M. Waller, Princess Mary's R.A.F. Nursing Service.

A.F.M.: F/Sgt. H. W. Gibson; F/Sgt. R. A. G. Hedges; F/Sgt. C. W. Lyons; F/Sgt. H. W. Mackenzie; Sgt. H. A. Bell.

B.E.M. (Mil.): F/Sgts. C. E. Brown; G. K. Cook; D. Cooper; J. Cosgrove; J. Grimshaw; A. G. Lenz; E. J. Moore; A. Sutton; B. F. Vernon; A. W. G. Verrill; R. L. Wall; J. Wise; C/Techs. P. R. Birkett; R. Evans; W. G. Grey; R. A. Honeybone; V. T. Kidson; J. Maggs; J. L. Owens; F. E. J. Parsons; R. Swift; T. H. A. Waite; Acting F/Sgts. G. R. J. Holt; J. Holt; J. Langford; Sgts. A. F. Beddoes; W. J. Cochrane; O. G. Dowell; P. R. Kennett; C. R. Knutton; R. Ludbrook; D. D. Nesbitt; I. B. Robinson; R. P. Stennings; A. C. Walker; T. B. White; Acting Sgt. K. A. Symes; Cpls. J. J. Curran; J. H. G. Dartnall; M. J. Melvin; J. Smith; Cpl/Techs. G. D. Warburton; R. J. E. White; S. A/C.s J. W. Love; J. A. W. Wilson.

Queen's Commendations for Valuable Service in the Air: Acting G/C. D. Iveson, D.S.O., D.F.C.; W/C. C. H. Saunders, D.F.C., Rtd.; Acting W/C. R. W. Payne, A.F.C.; S/L.s D. A. Arnott, D.F.C.; G. P. B. Bailey; D. S. Collier, A.F.C.; L. Harrington; E. P. G. Jeffery; J. T. Jennings; B. Sherwin; F/L.s G. Bingham; D. G. Brady; G. T. Bridson; C. J. Broom; G. H. Carter, A.F.C.; R. E. A. Driver; J. W. A. Elias; J. F. S. Finnis; B. Froehlich; J. E. George, Rtd.; L. Meadows; J. P. H. O'Neill; F. G. Ritchie; M. A. Sproule; J. V. Stiver; A. F. Sunderland-Cooper; O. G. Thomas; J. A. Windust, A.F.M.; R. C. Wood; F/O.s W. J. Henson; A. B. Kennedy; W. S. Lamont; R. Woollett; M.Plts. R. W. Drown; F. J. Loveridge, A.F.M.; M.Nav. R. T. Dyer; M.Eng. J. H. Laurie; F/Sgt. J. Palliser; Sgt. J. D. James; Lt-Col. C. D. S. Kennedy, Army Air Corps.

Commonwealth Air Forces

OFFICERS and N.C.O.s of the R.A.A.F. and R.N.Z.A.F. who have received honours and awards in the New Year list are as follows:—

Honours

ORDER OF THE BRITISH EMPIRE

Commander: A. Cdre. R. F. M. Green, R.A.A.F.

Officers: G/C. J. F. Lush, R.A.A.F.; W/C. L. Bacon, R.A.A.F.; W/C. A. C. Anderson, R.N.Z.A.F.

Members: F/L. A. J. Holden, R.A.A.F.; F/L. H. M. Eccersall, R.N.Z.A.F.; W/O. H. W. G. Dean, R.A.A.F.; W/O. H. L. Gregg, R.A.A.F.; W/O. T. F. Fountaine, R.N.Z.A.F.

Awards

A.F.C.: S/L. R. F. Drury, R.A.A.F.; F/L. K. J. Murray, R.A.A.F.; F/L. J. C. Buckmaster, R.N.Z.A.F.; F/O. N. R. Lang, R.A.A.F.

B.E.M. (Mil.): F/Sgt. J. F. Benck, R.A.A.F.; Sgt. I. R. Vater, R.A.A.F.; L. A/C. J. Walcott, R.A.A.F.

Queen's Commendation for Valuable Services in the Air: W/C. V. B. Cannon, R.A.A.F.; F/L. D. McF. Stark, R.N.Z.A.F.

Fleet Air Arm

SIX Fleet Air Arm officers have been named as recipients of New Year honours and awards. Vice-Admiral A. N. C. Bingley, C.B., O.B.E., Flag Officer Aircraft Carriers, becomes a K.C.B.; Acting Capt. M. Bruce, Department of the Director-General, Aircraft, is made an O.B.E.; there are three M.B.E. appointments—Cdr. N. Perrett, formerly C.O. of No. 800 Sqn. and leader of the Sea Hawk formation aerobatic team at last year's Farnborough display; Lt-Cdr. G. C. J. Knight, D.F.C., who commands No. 848 Sqn.; and Lt-Cdr. C. R. Heaton of the A. and A.E.E., Boscombe Down. Cdr. P. C. S. Chilton, whose award of the A.F.C. is included in the R.A.F. list, is also at the A. and A.E.E., where he commands "C" Squadron.

SERVICE AVIATION . . .

New Air Marshal

A PROMOTION not included in the half-yearly list, but which also took effect on January 1, was that to Air Marshal of A.V-M. W. H. Merton. At present A.O.A. at Bomber Command, Air Marshal Merton was made a K.C.B. in the New Year Honours.

R.A.F. Promotions

THIRTEEN new air commodores have been named in the half-yearly list of R.A.F. promotions, which took effect on January 1. The full list (excluding the names of those promoted to air vice-marshal, which were given last week) is as follows:—

G.D. Branch

G/C to A. Cdre.: J. F. Roulston, R. C. Ayling, T. W. Piper, H. E. C. Boxer, P. T. Philpott, T. B. de la P. Bereaford, F. E. Rosier, A. A. Case.

W/C. to G/C.: D. F. Dennis, J. R. Armitstead, G. F. Lerwill, J. Ellis, J. E. Preston, G. B. Warner, C. V. Winn, A. M. Ruston, E. H. Lynch-Blosse, J. B. Wray, P. Norton-Smith, E. P. Wells, A. H. W. Ball, N. M. Maynard, C. P. N. Newman, E. F. J. Odoire, J. T. Shaw, I. S. Smith, C. D. North-Lewis, P. M. Brothers, F. B. Sutton, H. A. C. Bird-Wilson, J. F. Davis.

S/L. to W/C.: C. G. Reeve, K. S. Booth, A. J. H. Kitley, B. A. Colvin, P. W. Lovell, R. J. V. Smyth, P. G. K. Williamson, J. S. Hart, B. R. M. Wade, P. J. Kelley, E. K. Paine, S. J. Rawlins, R. G. Churcher, J. A. Wright, P. W. Gilpin, A. R. Scott, P. D. Thomson, W. A. Thynne, A. C. Hollingsworth, W. K. Greer, K. R. Penry, H. G. Davies, C. A. Rennie, C. L. C. Mason, W. S. O. Randle, P. P. Villa, D. N. Shepherd, O. L. Hardy, J. E. Bazalgette, R. G. Wilson, P. D. Thorne, D. Roberts, W. S. Northcott, E. G. Alcock, R. C. Everson, J. R. Saunders, L. G. A. Reed, J. G. Claridge, K. B. Rogers, B. L. Partridge, W. D. Robertson, M. Mays, R. F. Hitchcock, W. D. Hooper, B. Hamilton, R. W. G. Freer, L. S. Laughton.

S/L. to W/C. (*Supplementary List*): W. J. Gregory, J. H. C. Dickie.

F/L. to S/L.: J. L. Farr, D. R. Mallett, G. Curry, H. Goldstone, G. R. Price, L. C. Spargo, A. Waterworth, J. H. Dyer, J. M. Maud, M. E. Townsend, J. A. Ormerod, M. E. J. Hickmott, V. D. Young, W. I. Macauley, R. J. T. Buchanan; G. H. Stewart, A. N. McGlashan, H. G. Clark, K. W. Johnson, J. G. Greenhill, K. McD. Flett, H. G. Huyton, P. G. Middleton, R. R. Austin, R. S. Brand, A. P. Trowbridge, R. H. Hinton, B. J. S. Knight, C. Fountain, H. Watkin-Jones, A. B. Stinchcombe, W. J. Woodcock, I. L. M. Johnston, C. P. Starck, J. H. Palmer, D. S. White, R. J. Spiers, W. F. Knapper, G. S. Goodsell, D. L. Pinn, E. D. Blake, R. D. Hillary, J. F. Stewart, F. B. Yetman, C. P. Woodroffe, L. C. Swalwell, R. E. Dayah, J. E. Horsfall, D. B. Craig, W. E. Bliss, H. J. Bromwich, R. Ramirez, R. L. Bennett, K. G. Hunter, P. K. V. Hicks, B. E. Harvatt, J. S. McRostie, P. Kent, M. G. Bradley, J. L. Price, R. Watson, L. J. Russell, E. P. Bennett, C. J. Trevains, J. A. Macpherson, P. A. Gifkins, C. F. P. Thompson, E. W. J. Morris, R. Hollingsworth, R. C. Wood, J. A. McArthur, T. M. Fennell, S. J. West, R. Hampton, H. A. Merriman, K. A. C. Wirdnam, J. Fraser, J. E. Pollington, D. C. A. Lloyd.

F/L. to S/L. (*Supplementary List*): C. H. Bird, A. Perry, G. C. Knowles, R. W. Allwright, B. A. Fraser, E. A. Dick, J. E. Burrell, A. S. Williams, A. R. Daw, C. H. Lowne, R. Clarke, E. H. Thompson, K. M. Frost.

Technical Branch

G/C. to A. Cdre.: C. C. Morton, B. Ball, H. G. Leonard-Williams.

W/C. to G/C.: M. L. Gaine, J. T. Arklay, J. L. Davey, R. C. Fordham, C. K. Street, J. A. R. M. Reid.

S/L. to W/C.: H. G. A. Scilley, R. E. G. Piff, R. F. Jones, H. Ball, L. E. Francis, J. A. Theophilus, T. de T. Macdonald, T. U. Dunn, R. Lee, H. Woolstencroft, W. E. D. Makin, D. C. Williams, L. Kendrick, P. Green, C. S. Thomas, I. J. de la Plain, G. H. Ford, C. J. Turner, J. Staff-Brett.

F/L. to S/L.: L. D. W. Coombes, A. S. D. Burke, A. Burdess, R. E. Wardrop, P. M. Passmore, T. Moore, C. A. Fieldhouse, J. E. Van Puyenbroek, C. A. Cawthorne, T. J. Thomas, D. B. J. Hicks, P. Woolley, F. H. E. Nunwick, H. F. Paling, L. N. West, D. A. Thomas, R. P. Dollimore, A. V. H. Palmer, B. P. Murphy, J. R. Tilleard, D. H. R. Weston, G. E. Trevains, A. Ford, H. Penny, T. J. Darvell, D. H. J. Martin-Jones, J. D. Jones.

F/L to S/L. (*Supplementary List*): E. C. C. White, L. I. Morgan, J. O. Bradley, H. J. Simms.

Equipment Branch

G/C. to A. Cdre.: C. J. Salmon.

W/C. to G/C.: S. J. Bryant, S. J. Popham-Pursey.

S/L. to W/C.: N. V. Carter, G. D. Dillabough, R. M. W. Henderson, C. W. Lovatt, K. E. Hollom, J. C. Archibald, W. A. Harris, M. Driscoll, W. G. Lydan.

F/L. to S/L.: E. W. Keene, E. Chelmick, E. J. Baker, S. J. Acons, T. K. Rourke, E. H. R. Falk, E. A. Wass, J. Burridge, R. E. Lipscomb, W. F. M. B. Buchan, P. S. Hose, L. Hodges, W. F. Langley, F. McGonigle, E. A. Wiseman, A. Gill, H. J. D. O'Connell, J. A. Foster, K. J. Luton, J. C. G. Wilson, F. G. Galloway, E. R. Mansfield, H. G. Johnson, A. J. Hone, A. J. Spence.

F/L. to S/L. (*Supplementary List*): J. G. Rutherford, C. H. Norris.

Secretarial Branch

W/C. to G/C.: A. R. Pruddah, R. J. Walker.

S/L. to W/C.: J. H. McMichael, A. J. D. Maclachlan, G. Packe, E. A. Challis, W. D. Rooney, S. W. Timmis, G. A. Sentance, F. H. A. Campbell, N. S. Fear.

F/L. to S/L.: J. L. Sharp, M. K. B. James, J. C. Evans, R. J. Meredith, L. J. Madders, N. G. Payne, S. Turner, D. G. Webb, R. Falconer, W. F. Lloyd, L. T. Walton, R. G. Hillen, B. W. Mullen, R. A. L. Simpson.

F/L. to S/L. (*Supplementary List*): R. Beill, P. E. Lewis.

R.A.F. Regiment

W/C. to G/C.: R. J. H. de Brett.

S/L. to W/C.: D. G. Roberts.

F/L. to S/L.: W. D. Ratcliffe, S. Broadbent.

Marine Branch

S/L. to W/C.: S. J. B. Snowden.

Medical Branch

G/C. to A. Cdre.: J. B. Wallace.

W/C. to G/C.: J. St. C. Polson, R. O. Yerbury, J. S. Howitt.

Dental Branch

W/C. to G/C.: W. A. H. Smith.

Education Branch

S/L. to W/C.: F. A. Coleman, E. H. B. Martin, A. R. M. Watts.

Provost Branch

W/C. to G/C.: C. S. Harley.

S/L. to W/C.: L. W. C. Lewis.

F/L. to S/L.: F. W. Kendrick.

F/O. to F/L. (*Supplementary List*): J. C. Ellender, R. W. Gunn.

Catering Branch

S/L. to W/C.: K. C. C. Hicks.

F/L. to S/L.: E. A. Vautier.

Physical Fitness Branch

F/L. to S/L.: B. F. Stannard.

W.R.A.F.

Secretarial Branch

Flt/Off. to Sq./O.: H. M. A. Crawford.

F.O.A.C. Appointment

SUCCEEDING Vice-Admiral A. N. C. Bingley this month as Flag Officer Aircraft Carriers, Rear Admiral C. L. G. Evans has been Deputy Chief of Naval Personnel (Officers) since October 1957 and prior to that was Flag Officer Flying Training. He is one of the most famous Naval pilots of the Second World War, having won the D.S.C. in 1940 and the D.S.O. the following year and been three times mentioned in despatches. In 1953 he was made C.B.E., after commanding the light fleet carrier *Ocean* during the Korean War, and he is also a C.B.

Fighter Command Post

WHEN he takes up the appointment of Senior Technical Staff Officer at Fighter Command headquarters on March 1 with the acting rank of air vice-marshal, A. Cdre. T. U. C. Shirley will become the first former R.A.F. wireless apprentice to have reached that rank. He joined as an apprentice in 1925, then three years later was awarded a cadetship at the R.A.F. College, Cranwell, from which he was commissioned in 1930.

A. Cdre. Shirley is at present A.O.C. and Commandant of the R.A.F. Technical College, Henlow, a post which he took up in January 1957. He had previously been at Fighter Command (before taking the 1956 Imperial Defence College course) from 1953 as Command Signals Officer. He was appointed an A.D.C. to King George VI in 1950 and afterwards to H.M. the Queen; he is a C.B.E. and F.R.Ae.S. and a member of the Institution of Electrical Engineers.

F.A.A. Promotions

PROVISIONAL R.N. promotions, to date from June 30 this year, include the following Fleet Air Arm officers and R.N. officers serving in aircraft carriers or air establishments:—

Commander to Captain: I. S. McIntosh, D.S.O., M.B.E., D.S.C., H.M.S. *President* (late executive officer, *Ark Royal*); P. L. Langly-Smith, executive officer, *Eagle;* W. C. Simpson, O.B.E., D.S.C., *Walkerton,* in command and as Senior Officer 104th C.M.S. Squadron (late staff of F.O.A.C.); W. B. S. Milln (engineer officer), *Victorious*; G. A. Hewett, D.S.C. (engineer officer), *Ark Royal*; D. F. Butlin (engineer officer), Department of the Director-General, Aircraft.

Lt-Cdr. to Commander: L. D. Urry, Air Warfare Division; D. W. Foster, Direction Officer, *Eagle*; H. J. Abraham, Lieutenant Commander (Flying), *Eagle;* R. C. Fisher, Direction Officer, *Victorious*; I. H. F. Martin, D.S.C., *Daedalus*; F. Bromilow, C.O. No. 849 Sqn.; D. B. Morison, First Lieutenant, *Britannia* (formerly C.O., No. 898 Sqn.); I. S. S. Mackay, Navigating Officer, *Albion*; J. M. Forbes, Air Warfare Division; R. L. Garnons-Williams, Gunnery Officer, *Eagle*; W. H. Cowling, C.O. No. 898 Sqn.; D. L. G. James, C.O. No. 719 Sqn.; C. A. Brown (engineer officer), Naval Air Maintenance Development Unit; K. B. Birkett (engineer officer), R.A.E. Farnborough; M. Roberson (engineer officer), Department of the Director-General, Aircraft.

NEWS IN BRIEF

A. Cdre. G. C. Hartnell, S.A.S.O. at R.A.A.F. Home Command since 1955, arrived in the U.K. recently to take this year's Imperial Defence College course.

* * * * *

An Air Week is being held at Brighton prior to the R.A.F.A. Annual Conference there on June 6 and 7.

* * * * *

Vacancies will occur during the next few months for no fewer than 500 aircraft apprentices and 100 administrative apprentices to begin training in May for advanced ground trades in the regular R.A.F. Full details are contained in A.M. Pamphlet 339, obtainable from the Central Recruiting Office, Air Ministry, London, W.C.1, or from any R.A.F. recruiting centre.

* * * * *

Mr. Stanley Brogden, who has been director of R.A.A.F. public relations since 1951, is resigning as from today (January 9) to devote himself to free-lance journalism. He is being succeeded by Mr. H. Ross Rayner.

Straight and Level

YOU know how difficult it is even in the quietest turbine airliners to eavesdrop on neighbouring conversations. The other day my pricked-up ears were tantalizingly assailed by the following snatches of conversation from the seat row directly behind me:—

"Shocking, shocking . . . don't you think? . . . dear, oh dear, oh dear . . . tut, tut . . . how am I going to get rid of all my piston airliners? . . . any ideas? . . . oh dear, oh dear . . . and how am I going to pay for all these jets? . . . you don't think I have gone crazy, do you?"

Although it was frightfully bad-mannered of me, I couldn't resist a quick glance over the top of my seat. I just *had* to see who was talking to whom.

There, all alone, and still clutching the shield and trident of Britannia which he had worn at the Chelsea Arts Ball the previous night, was Sir Charles Boost.

He had been talking to himself.

Dreadfully shocked, I sank back into my seat, stricken with remorse at having thus violated the privacy of this great man's innermost soul. I felt as though I had been eavesdropping at the keyhole of a confessional. Could Sir Charles, the high-priest of air transport bravura, be wobbling and weakening in his faith?

● When I had composed myself I tried to salve my stricken conscience by trying to work out an answer to the problem of how the airlines can dispose of their prematurely retired piston equipment. In a flash of brilliant inspiration the answer came to me.

Melt them all into a gigantic aluminium obelisk, for permanent enshrinement near the International Aviation Building in Montreal. Upon each face of the monument emboss bas-relief scenes symbolizing the grotesque consequences of airline quality-competition—emaciated airline presidents in a bread queue, perhaps. Or happy men, women and children clambering aboard steamships and trains. Or ugly scenes of delegates at an I.A.T.A. fares conference locked in savage combat.

And at each corner of the obelisk erect huge torches, immortal fires forever fuelled by heaps of supersonic-airliner brochures.

● It must have been rather a shock for Cranwell to hear A.V-M. Sir Richard Atcherley, C-in-C. Flying Training Command, declare that the passing-out parade he was taking was "as valid as a marriage in Las Vegas." Only an Atcherley could get away with that sort of remark at the Sandhurst of the R.A.F.; and Sir Richard, of course, had a perfectly reasonable explanation.

He and his twin brother David had been rejected at their preliminary Cranwell medical in 1922, Dick because of his eyes and David owing to kidney trouble. When they returned for another examination the doctors got them mixed up (which sounds rather like a W. S. Gilbert plot, but this is exactly what the C-in-C. said happened). As he put it: "I passed in with flying colours on David's eyes, and he on the strength and quality of my —er—slightly more vulgar but none the less useful contribution."

● In the next few weeks I expect two far-reaching decisions to be made. In Paris, I.A.T.A. may succeed in reaching agreement about jet fares. And in Montreal I.C.A.O. may agree upon the future international navigation aid—Vortac or Decca.

Enough, for the moment, has been said about jet fares. But what about VOR versus Decca? The Americans want VOR, the British want Decca. Some brute force and ignorance can be expected, because—as in the jet *v.* turboprop controversy—big business and politics are involved. Quite a lot has been said on this subject too—except just one thing.

The American conference-table argument will be that hyperbolic systems (i.e. Decca) are technically inferior to rho-theta (VOR) systems. But if indeed they argue thus it will be extremely difficult for them to promote their hyperbolic system when it becomes available.

But to be thoroughly cynical, technical somersaults are aviation's No. 1 sport. "This is a changing world," people say as they prepare themselves—and you—for the next somersault.

● Problems of security classification will, I suppose, always be with us. One of the most vexing things is that the majority of security-classified documents are never declassified—even after a dozen years. Those who might be able to learn from them perhaps never even know of their existence.

In America an excellent scheme is being introduced. After stated periods of either five or ten years all documents will automatically be declassified entirely. The sponsor has to decide in advance which ones he must continue to protect—his reasons must be demonstrably sound—and then take action to reclassify them.

ROGER BACON

We know about the Comet as a symbol of British leadership, etc. Here it is as a symbol of food and drink. I would like to have said *British* food and drink, but "The Comet" pub on the right—D.H.106 Comet, not D.H.88—is in Dublin. (Just down the road, incidentally, is "The Viscount.") On the left, all iced-up though a piece of cake, is a Comet atop Shell's Christmas cake. In the picture are G/C. Douglas Bader of Shell and Capt. Jerry Shaw of de Havilland

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Cockpit Conservatism

AFTER reading Cdr. Goodhart's article "Conservatism in the Cockpit" (*Flight*, December 26), I find that with the exception of his reference to sloping instrument-panels, I disagree with all the other points made.

Firstly, it must be agreed that some controversy has existed as to whether the orthodox rudder works in the natural sense, but I have long been under the impression that the majority of pilots agree that this is, in fact, the case. In this respect I recall that whilst attending one of the Air Ministry's first gliding courses in 1944 this very point arose. Out of something like 14 cadets, none of whom had ever received any form of flying training before, only one was found to have a natural inclination to "push the wrong way," and this at a time when we were all riding motor-cycles or pedal cycles.

Concerning the position of the control column, it seems evident that Cdr. Goodhart's remarks are directed at Service aircraft, for there must be very few modern commercial aircraft with centrally located columns; even the Dakota, going into production a quarter of a century ago, was provided with controls that gave easy "access to and egress from" the seat.

Last but not least, we have the fact that the anti-collision rules are contrary to the accepted convention that the pilot actually flying the aircraft normally (but not always) occupies the left-hand seat. This point has been raised personally during the oral tests for the senior licences, but the fact is that the left-hand seat convention was accepted long before Schedule II of the A.N.O. was drafted; so why don't we first change the rules and not the seats—it's so much easier?

Rhoose, Glam. B. A. SPARROW.

THE comments of Cdr. H. C. N. Goodhart ("Conservatism in the Cockpit," *Flight*, December 26) are most welcome and interesting. The questions he puts forward relating to the left-hand command position and the left-hand circuit prompt the general reply that this is a subject in which half the aviation fraternity are not interested, because they are content to leave well enough alone, whilst the other half enters into heated debate on the reasons why.

I think that really to answer such questions we have to go back into history; further back than the start of flying and even further back than the dawn of transport. Most religions, or superstitions, taught that the right side and hand of man predominated over the left. When ships with sails and steering oars appeared it was assumed that the steering oar and the right hand of the helmsman should be on the right side of the ship, because by custom that was the stronger; hence starboard ("steerboard"). By jumping the intervening centuries we come to the first aircraft, particularly those in which the pilot sat on the centre line. The principal pole, wheel or stick was either put to his right hand or was so arranged in conjunction with other controls that it was more natural for him to effect primary control with the right hand; there were exceptions, but the general tendency was that way.

Having settled, or unsettled, the problem of "left hand, right hand" we come to the circuit direction. It has been suggested that in the early aircraft it was much easier to make an approach to land with one's head and body inclined to the left, either when side-slipping or to improve the view ahead, because in that attitude the right hand on the controls was not restricted in its movement by the body. All this might have encouraged a predilection for the left-hand circuit. In this connection I was disappointed that Cdr. Goodhart did not have anything to say about aircraft-carrier circuitry.

In addition to the avoidance-of-collision rules, the rules of the air include right-side separation on airways, so that the captains of aircraft sit on the "passing" side—as also do road drivers.

Cdr. Goodhart's reference to the difficulty of the trainee pilot in getting used to the unnatural way in which the rudder bar moves is interesting. The original choice might have been influenced by the tiller-rope arrangement of a rowing boat.

Incidentally, the original R.A.F. Valetta, as you will no doubt recall, had the principal pilot's position on the right-hand side, as also did some of the early Fokker transports.

London, N.W.2. L. F. E. COOMBS.

FORTHCOMING EVENTS

Jan.	13.	R.Ae.S.: "Stress Corrosion—the Engineer's View," by P. H. Wall.
Jan.	15.	British Institution of Radio Engineers (Scottish Section): "Satellite Development and the Moon Rocket," by P. H. Tanner (at Glasgow; repeated on Jan. 16 at Edinburgh).
Jan.	15.	R.Ae.S.: Presidential Address.
Jan.	16.	Institute of Navigation: "Blind Landing Problems," by W. J. Charnley.
Jan.	17.	Aircraft Recognition Society: All-England Contest.
Jan.	21.	Manchester Metallurgical Society (Institute of Metals): "Investigation of Metallurgical Failures in Aircraft," by D. A. Ryder.
Jan. 26-29.		Institute of the Aeronautical Sciences: 27th Annual Meeting.
Jan.	27.	R.Ae.S.: "The Noise Problem in Relation to Engine Design," by P. Lloyd.
Feb.	5.	R.Ae.S.: First Halford Memorial Lecture, by J. L. P. Brodie (at Hatfield Branch).
Feb.	6	Helicopter Association: "Some Engineering Aspects of Helicopter Assessment Trials," by H. J. Webb.
Feb.	7.	British Interplanetary Society: "High-energy Fuels and Rocket Propulsion," by Dr. F. Fitzgerald.
Feb.	9.	R.Ae.S. Guided Flight Section: "Theoretical Studies of Guided-missile Control Systems," by E. G. C. Burt.

R.Ae.S. Branch Fixtures (to Jan. 16): Jan. 12, *Henlow*, "Vertical Take-off and Landing," by D. Keith-Lucas. Jan. 13, *Boscombe Down*, "Experiences on the Trans-Antarctic Expedition," by S/L. J. H. Lewis. Jan. 14, *Brough*, Young People's Christmas Lecture; *Chester*, "Development of the Civil Avon Engine," by E. Eltis; *Christchurch*, "The Rotodyne," by Dr. G. S. Hislop; *Manchester*, "Nuclear Reactors for Power Production," by T. M. Greenlees. Jan. 15, *Glasgow* (Graduates' and Students' Section), question night and film show. Jan. 16, *Cambridge*, lecture by Dr. N. A. de Bruyne.

RETROSPECT

From "Flight" of January 9, 1909

Sir,—I was much interested in Mr. Moore-Brabazon's letter in *The Automotor Journal* of January 2nd. It is a standing rebuke to Englishmen that he can advise—and with good reason—any experimenters to go to France. In Paris one feels the beating pulse of a new era. It causes no surprise if, on looking up, one sees a "direagable" performing graceful evolutions; picture postcards of all the aeroplanes command a ready sale; aeroplanes in flight forms one of the chief advertisements for many of the cinematograph entertainments; and on the evening following Wilbur Wright's sensational high flying in connection with the "Height Prize" I saw it reproduced on the cinematograph at a lecture given by the Comte de la Vaulx on the "Conquête de l'Air". The humble enthusiast is not regarded as an "amiable lunatic" in France.

I was in Paris for a little over three months recently, and, not being blessed with too much time or money, I had to wait for an opportunity to visit Le Mans. At last it came—October 31st; a friend was going to Le Mans on his car. I was doomed to some degree of disappointment. A new carburettor float caused trouble by not being a free fit on the spindle; a tyre punctured, and an exhaust-valve spring broke; with the result we arrived at Auvours just as Mr. Wright finished his flight for the day. To add to our disappointment, we had come *via* Chartres, and had also missed M. Bleriot's cross-country flight near that town.

I am afraid that I have trespassed on your valuable time, but I must wish you every success with your new venture, *Flight*, and hope that it will do something to "wake up England."—*I remain, Sir, yours faithfully*, G. H. CHALLENGER.

Independent Operators and B.O.A.C.

WE refer to your news-item "Challenge to B.O.A.C.—2" on page 956 of your December 19 issue [concerning Air Charter's application to operate inclusive tours to New York for an all-in charge of £165].

In this connection we would like to draw your attention to the fact that Eagle Aviation originally applied for an inclusive-tour scheduled service on the north Atlantic route as long ago as February 1957.

This was rejected, and we subsequently applied again in June 1957, July 1957, June 1958 and November 1958, all of which applications have been similarly rejected.

As you will be aware, no reason is given for rejection, but since B.O.A.C. objected to all of the above applications it is fair to assume that the Corporation was able to convince the Air Transport Advisory Council that such services would cause material diversion of passengers from their own services.

London, W.2. EAGLE AVIATION LTD., G. W. Pitt, Director

Unidentified Objects

OTHER readers may be interested, and able to offer helpful comments, on the following. At between 10 and 10.30 a.m. on December 30 I saw three B-52s flying north over Esher, Surrey. They were at about 20,000ft, and contrailing, and a good pair of binoculars showed two of them to be carrying, in each case, an object some 30ft long (about the length of Rascal) under the starboard wing, between the inboard and outboard engines. The missile (if such it was—I am certain it was not a drop tank) was painted a bright, possibly fluorescent, red. Two friends of mine also saw the aircraft.

Tolworth, Surrey. T. N. SIMPSON.

ONDON